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ABSTRACT

This document, which was developed as a resource for adult basic education teachers in Victoria, Australia, contains six units of science activities to help students develop literacy and numeracy skills while learning basic scientific concepts. Presented in the introduction are guidelines for using the material and a table detailing those basic skills required of students seeking Certificates of General Education for Adults that are covered in each activity. The 38 science activities are organized into 6 units with the following titles: food for thought; cabbages, cleaning, and chemistry; seeing the light; green issues; memory and learning; and science and society. Each unit contains the following types of materials: introductory and background materials for teachers to use when introducing the scientific concepts covered in the unit; details and instructions about the various science activities (including lists of materials needed, step-by-step procedures, and suggestions for follow-up or discussion of the activities); and worksheets to be photocopied and distributed to students. Concluding the document are lists of the following: 25 print/nonprint references and resources recommended for use with the individual units and addresses of 12 sources of resources, 12 other sources of ideas and information, 7 other useful addresses, and 6 possible excursion ideas. (MN)

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Slices of Science

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TO THE EDUCATIONAL RESOURCES

Slices of Science:

a resource for Adult Basic Education

Project Officer: Avril Blay
Council of Adult Education, Melbourne

Published by the Adult, Community and Further Education Board, Victoria 1994

Slices of Science
Avril Blay

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Avril Blay
Project Officer

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Nancy Jones
Project Manager

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Introduction

The content of the Adult Basic Education curriculum has often been wide ranging but has rarely included much science. There are many reasons for this, an important one being the scarcity of activity-based science resources for adults developing their language and maths skills. ***Slices of Science*** suggests a few ways of filling this gap and also points to the possible role science might have in the Adult Basic Education (ABE) curriculum.

These materials are the result of ideas and work by practising teachers[1] of Adult Basic Education. Most of the contributors have a background in science. The aim was to produce materials that are easy for people to use, that demystify science, relate it to everyday life, introduce topics through interesting and enjoyable activities and provide an extra stimulus through which to develop language and maths skills.

This pack is not a comprehensive science curriculum. The activities here are samples of things that have worked for various teachers. Also included are ideas adapted from other materials that seemed to be useful. The aim is to increase awareness and understanding of scientific and technological issues with a focus on science as a human activity in a social context.

Nearly all materials will need to be adapted to suit varying situations - these are no different. We hope teachers will pick and choose, dip into the pack to find things of interest and encourage their students to do the same. While most of the units talk mainly to the teacher, we hope they are also reasonably accessible to students. An attempt has been made to present language that is varied, straightforward and unpatronising.

The units all aim:

- to provide an activity that students and tutors will enjoy doing.
- to provide an opportunity for developing a variety of language skills.
- to present science as a part of everyday life through activities that use common household articles and substances that are easy to get hold of and familiar.

Occasional use of a kitchen or even just a source of heat such as a camping stove is assumed. Access to a laboratory is not necessary for the activities here. Sometimes units may raise more questions than they answer. We hope this will encourage people to do their own research and realise the inquiring nature of scientific investigation.

Teachers without a science background may want to make their own limitations clear - (we're all learning this together - this is as far as I can go - where else can we get information or advice?). Sometimes notes are included as background for teachers - but which may also interest some of their students.

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[1] Where the word teacher is used we are also referring to teachers, tutors and trainers. For the sake of simplicity only teacher, or sometimes tutor, is used.

Much has been written about gender issues and science teaching. Men dominate science while women have often been exploited by it and excluded from it. Research into this area has suggested that the language and methodology of traditional science teaching often alienates women and girls. The focus in ***Slices of Science*** is thus on particular activities as an ***accessible introduction*** to science. Some groups and teachers may want to consider more closely scientific language, methods and approaches as they come up or as interest in them develops. There are many good publications which will help to do so. Other groups may want to develop their own ways of thinking and writing about activities and experiments. Both the level of the group and notion of different genres of writing for different purposes are important here. ***Slices of Science*** includes contributions from teachers with varied approaches. Some units are more traditionally 'scientific' than others and the methodology demonstrated can easily be transferred to other units if this is the purpose of a particular group.

Generally, some strategies which have been developed to increase girls' and womens' interest in science have been adapted here as a good way of introducing anyone studying Adult Basic Education to science. There is still debate in this area and some concern at the possible dangers of stereotyping that could result from ideas of only a particular sort of science being suitable for women or girls.

A basic principle of Adult Basic Education at the Council of Adult Education is that the core of literacy work is the development of creative, critical and connected thinking. Students read and write about a whole range of subjects, ideas and topics. We hope that ***Slices of Science*** will help them to think critically and creatively about science.

How to use the resource

As mentioned earlier, ***Slices of Science*** is not meant to be a comprehensive science curriculum, and nearly all the materials will need to be adapted to suit varying situations, with teachers choosing and dipping into the pack to find things to use. There are three types of materials in the units:

Background:

This introductory and background section introduces the scientific concepts being introduced in the unit. This material, although written for the teacher, could also be used as reading material for higher level students.

Guide:

This section provides details and instructions about the various activities that can be undertaken with students. This includes information on the materials needed, what to do, and any further ideas for follow on or discussion.

Worksheet:

These sheets are designed as handouts or worksheets for students, and can be photocopied for this purpose.

The Certificates of General Education for Adults

The Certificates of General Education for Adults (CGE for Adults) within the Victorian Adult English Language, Literacy and Numeracy Accreditation Framework were introduced as an accredited adult basic education certificate and a curriculum framework for Victoria in 1993. Most of ***Slices of Science*** was written prior to the development of the CGE for Adults and the Accreditation Framework. In this section, which is an update, the following grids are an attempt to map the activities in ***Slices of Science*** onto the CGE for Adults and the Accreditation Framework.

Most units can be developed in some way across all streams of the CGE for Adults (*Reading and Writing*, *Oral Comunication*, *Numerical and Mathematical Concepts*, and *General Curriculum Options*) and across most of the four levels. Teachers and students can explore the activities at the appropriate level for the students. Hence there is no attempt in the grids to nominate the levels of the individual activities, as this is dependent on how the teacher uses the material and the ideas. Generally, most of the activities, as written, would be at levels 2 or 3. The **Background Reading** material at the start of each unit is often at a higher level, and if used as it is would be very suitable as levels 3 and 4 *Reading for knowledge* material.

Selections of the material can be used as theme and content material for study in one or more of the streams. Most of the activities are suitable for use in a Science based *General Curriculum Option* subject, especially if students are given some responsibility for organising and collecting materials for experimentation.

The following grid is organised according to the four streams with *Reading* and *Writing* done separately, then Oracy (*Oral Communication*), Maths (*Numerical and Mathematical Concepts*) and *General Curriculum Options*. These streams are described in further detail.

For the streams of Reading, Writing and Oracy there are four domains:

- Self Expression
- Knowledge
- Practical Purposes
- Public Debate.

For the Maths stream, there are five strands:

- Number
- Data
- Algebra
- Space
- Measurement

The *General Curriculum Options* refer to the seven Mayer competencies:

- can collect analyse and organise information
- can plan and organise activities
- can communicate ideas and information
- can work with others and in teams
- can use mathematical ideas and techniques
- can solve problems
- can use technology

Slices of Science & the Certificates of General Education for Adults

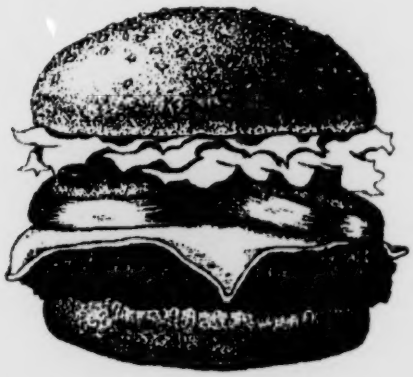
Unit	Reading	Writing	Oracy	Maths	General Curriculum Options
Food for thought **Background reading**	• knowledge			• measurement • number	
Fast food	• knowledge • practical purposes		• knowledge • public debate	• data	• can communicate ideas and information
Fat science	• knowledge		• knowledge • public debate	• data • measurement	
Margarine tasting	• practical purposes	• practical purposes • knowledge	• knowledge • public debate	• data	• can collect analyse and organise information
Grease spot	• practical purposes	• practical purposes • knowledge	• knowledge	• data	• can collect analyse and organise information • can communicate ideas and information • can plan and organise activities
Measuring marge	• knowledge • practical purposes	• practical purposes • knowledge	• knowledge • public debate	• data • number • measurement	• can solve problems • can collect analyse and organise information • can communicate ideas and information • can use mathematical ideas and techniques
Less fat	• knowledge • practical purposes	• knowledge • practical purposes			
A small fat quiz	• knowledge • practical purposes			• number	
Breakfast science	• knowledge • practical purposes		• knowledge • public debate	• data • measurement • number	• can plan and organise information • can collect analyse and organise information • can communicate ideas and information

Unit	Reading	Writing	Oracy	Maths	General Curriculum Options
Taste test - how sweet it is	• knowledge	• practical purposes	• knowledge • public debate	• number	• can communicate ideas and information
Less sugar	• knowledge	• knowledge			
Chocolates, apples & advertising	• knowledge		• self expression	• number	• can work with others and in teams
Food pyramid				• data	• can plan and organise activities
TV food advertising	• knowledge • public debate	• public debate • knowledge	• public debate	• number • data	• can plan and organise activities • can collect, analyse and organise information
Have a guess	• knowledge		• knowledge	• number • data	• can work with others and in teams
What are we eating?	• knowledge • public debate	• public debate	• public debate		
Cabbages, cleaning & chemistry Background reading	• knowledge			• number • measurement	
Cooking chemistry	• practical purposes • knowledge	• knowledge	• knowledge	• data • measurement • number	• can collect, analyse and organise information • can plan and organise activities

Unit	Reading	Writing	Oracy	Maths	General Curriculum Options
Hubble bubble whoosh	• practical purposes				• can plan and organise activities
Separation science	• knowledge • practical purposes	• knowledge	• knowledge		• can collect, analyse and organise information • can plan and organise activities
An orange a day	• knowledge	• practical purposes • knowledge	• knowledge	• measurement • data	• can collect, analyse and organise information • can plan and organise activities • can communicate ideas and information
Of cabbage and chemistry	• knowledge	• knowledge		• data	• can collect, analyse and organise information • can plan and organise activities • can communicate ideas and information
Making a skin cleanser	• practical purposes • knowledge			• measurement	• can plan and organise activities
Cleaning up	• practical purposes • knowledge		• knowledge		• can plan and organise activities
Invisible ink	• practical purposes • knowledge	• self expression			• can plan and organise activities
Seeing the light **Background reading**	• knowledge				
From gassy to gooey to ...	• knowledge • practical purposes		• knowledge	• measurement • data	• can solve problems • can plan and organise activities • can work with others and in teams
What colour is white?	• knowledge • practical purposes		• knowledge		• can plan and organise activities

Unit	Reading	Writing	Oracy	Maths	General Curriculum Options
Seeing sound	• knowledge • practical purposes	• knowledge	• knowledge	• number	• can plan and organise activities
Everyday electricity	• knowledge • practical purposes	• knowledge • practical purposes	• knowledge	• measurement • number	• can work with others and in teams
Tinkering	• knowledge • practical purposes	• knowledge • practical purposes	• knowledge • practical purposes	• space	• can work with others and in teams
Green issues **Local action on chemical hazards**	• public debate • knowledge	• knowledge • public debate	• public debate • knowledge	• measurement • data • number	• can collect analyse and organise information • can plan and organise activities
Rivers, pollution and salinity	• knowledge • public debate		• knowledge • self expression	• space • measurement	• can collect analyse and organise information • can plan and organise activities
Memory and learning	• knowledge	• practical purposes	• practical purposes		
Science in society **From durian to dialect**	• practical purposes • knowledge		• knowledge • public debate	• measurement	• can plan and organise activities • can work with others and in teams
Women in science	• knowledge				
Science is ...	• knowledge	• knowledge	• knowledge • public debate		• can collect analyse and organise information • can plan and organise activities • can work with others and in teams

1. Food for thought



This section contains a number of activities designed to investigate fat and sugar content in food and promote discussion and understanding of what is healthy eating.

Food for thought: background reading

A person needs food

- to provide **energy** for activity and to keep the body working
- to provide **essential substances** which are needed for the body to function properly.

Energy

Carbohydrates

The human body uses a substance called glucose as its source of energy or 'fuel'. Glucose is called a simple sugar and is present in the blood so it is circulated to all parts of the body. All body cells need a regular supply of glucose. Athletes sometimes have drinks with added glucose for 'quick energy'.

Normally glucose is obtained from other foods, mainly carbohydrates, which have been broken down or digested by the body into small units. Starchy foods like pasta, rice, potatoes contain lots of units of glucose joined together. Cane sugar (scientific name sucrose) and milk sugar (scientific name lactose) are made of one glucose unit combined with another simple sugar so glucose is easily obtained from them.

The body normally controls the amount of glucose in the blood. The normal range is 3.6 - 5.6 mmol./litre. Any extra glucose is first stored in the liver and muscles as a substance called glycogen and then eventually as fat all over the body. These three substances, glucose, glycogen and fat are sometimes compared to having ready cash, money in the bank and money on deposit.

Diabetics are unable to control the amount of glucose in the blood and their glucose levels can fluctuate wildly. They lack the hormone insulin which removes excess glucose from the blood, when there is too much present.

Fats

Fats, like carbohydrates, contain the elements carbon (C), hydrogen (H) and nitrogen (N). The proportions of the three elements are different in fats to those in carbohydrates such as sugar.

There is less oxygen in a fat and so if a gram of fat is burned or consumed in the human body more energy is released than for a gram of carbohydrate. This is why you can eat a greater mass of carbohydrate than fat before putting on weight.

Fats, oils and waxes are all in this group. Fats are usually solid at room temperature where as oils are liquid. Some foods in this group are lard, suet, olive oil, butter, margarine.

Because fats do not dissolve in water they are good storage products. Fat also forms an insulating layer under the skin to prevent heat loss. Blubber in whales and seals is such an insulating layer.

Important substances, such as vitamins A and D, cannot be used in the body unless they have been dissolved first. These vitamins only dissolve in fats. Fats are also an important component of all cells and particularly important in nerve cells.

Proteins

Proteins also contain the chemical elements hydrogen, oxygen, and carbon but also contain nitrogen, and sometimes sulphur. Proteins can also be a source of glucose and if you eat too much protein, the excess will be stored as fat. Meats, nuts, dairy products are high in protein.

The amount of energy an amount of food provides used to be measured in calories but now joules or kilojoules (1,000 joules) are the units used.

- one gram of carbohydrate gives 16.8 KJ of energy
- one gram of protein gives 17.6 KJ of energy
- one gram of fat gives 37.8 KJ of energy

A person needs a certain level of energy just to keep the body functioning even if there's no visible activity. This amount of energy is called the basal energy requirement.

- for a man it is 7,400 Kilojoules
- for a woman it is 5,400 Kilojoules

Essential substances

Vitamins and minerals

Vitamins and minerals are sometimes needed to build a part of the body eg. iron is needed to make red blood cells. Sometimes a chemical reaction in the body will not happen unless one of these substances is present.

Usually only small amounts of vitamins and minerals are required and would normally be found in a balanced diet. Taking large doses of vitamins is not a useful thing to do. Most of these aren't stored and an excess can make a person very sick.

Substance	Use	Effects of deficiency	Effects of excess
Vitamin A	Part of "sight" mechanism, maintains skin tissue	Poor night vision: blindness; changes to eyes and skin	Vomiting, headache, peeling of skin
Vitamin C	Involved in forming connective tissues of body	Scurvy	Reduces body's use of vitamin B12
Sodium	Carries nerve impulses, maintains body fluids	Cramp in muscle, loss of appetite	High blood pressure
Iron	Component of haemoglobin	Anemia	Damage to liver

This information from ***Web of Life*** Part One, Australian Academy of Science.

Sometimes these essential items need to be taken together; eg. iron is absorbed more efficiently if taken with vitamin C, so a glass of orange juice with toast or breakfast cereal is a good combination.

Some vitamins are destroyed by cooking and others dissolve in cooking water. Accordingly raw fruit and vegetables are the best source of vitamins.

Cholesterol

Cholesterol, the 'dirty word of the 90's' is not actually a fat. It belongs to a similar group called steroids, which have certain features in common with fats.

Cholesterol can be eaten in certain foods but it is also produced quite naturally by the human liver. It is used in the membranes of cells and is the basis for the body's production of various hormones such as oestrogen and cortisone.

If there is more cholesterol in the blood than needed, the liver has the job of removing it. The cholesterol is changed into bile salts and stored in the gall bladder. It now forms part of a liquid called bile and is a greenish colour. You may have seen bile vomited up in a 'bilious attack'.

Bile assists in breaking up fats in the digestive system into tiny droplets so chemical breakdown can occur. Sometimes an excessive amount of cholesterol causes the bile salts to solidify into gall stones. These are extremely painful and can block the outlet from the gall bladder into the digestive system. Sometimes the gall bladder has to be removed and people who have had this operation have to reduce the fat in their diets significantly.

When the blood contains too much cholesterol, the cholesterol can be deposited on the walls of the arteries in much the same way as water pipes can rust inside. In each case the flow of the liquid is obstructed. If blood flow is hindered, blood clots can form. This is called thrombosis.

Blood clots are dangerous wherever they form, but if this happens in the coronary arteries then a heart attack occurs. If it happens in a blood vessel in the brain, a stroke occurs.

Normal levels of cholesterol in the blood are 3.6 - 5.7 mmol./litre but can be higher in pregnancy. In conditions such as diabetes, cholesterol can rise also. A doctor will usually take measures if the level exceeds 5.7 mmol./litre.

Cholesterol is not found in vegetable oil but is present in eggs, offal, dairy products and processed meats. The general feeling in the scientific community is that a general reduction in the fats should be the response to lowering cholesterol levels. It is not so much the cholesterol eaten as that which is made by the body using the fats in the diet. Some fish oils seem to play a role in reducing blood cholesterol.

Salt and sugar

Salt (scientific name sodium chloride) is a necessary part of a human's diet. Only small amounts , however, are needed. Too much salt can lead to water retention and high blood pressure.

Salt, like monosodium glutamate (M.S.G) enhances the flavour of other foods. Salt is also a useful preservative. It prevents bacteria multiplying and spoiling food so processed foods often have high salt levels. Sugar is also widely used in processed foods both for taste and as a preservative.

Fibre and water

Fibre or roughage is indigestable plant material. Its bulk keeps the contents of the digestive system moving and its muscles in tone and prevents constipation. Fibrous foods are filling so people tend not to eat as much of them as they would of other foods to assuage hunger.

The human body is 70% water and the processes which keep the body running all require water. Water is continually lost from the body in breath, perspiration, tears, urine and faeces and so water is an important part of the diet.

Obesity

Obesity is a health problem for several reasons. If too much fat is deposited on the body, the heart can be strained trying to provide blood circulation. Obesity also tends to indicate too high levels of fats and sugars in the diet and these factors can lead to problems discussed earlier of "hardening" of the arteries or mature onset diabetes.

Obesity also often results in tiredness and lethargy and general feelings of ill health.

Fast food

An activity to start people talking and thinking.

What you need

Copies of the worksheet **Fast Foods: How healthy are they?**

What to do

Start by asking:

- 'Is there such a thing as good food and bad food?'
- 'Are some foods better for us than others?' 'How can you judge?'
- What rating would you give each of these takeaway foods? (see next page)

Note

- Higher ratings are given for less fat, less kilojoules and less salt.
- Other criteria that could be used are too little fibre and too much sugar.

Answers

hamburger	☆☆☆☆
pizza	☆☆☆
fried chicken	☆☆
spring rolls, chips	☆
take away Chinese meal	☆☆☆☆
meat pies, sausage rolls	☆☆

Fast foods: How healthy are they?

☆☆☆☆ best
☆ worst

Give each food the number of stars you think they deserve.

Food Rating:

Hamburger

Pizza

Fried chicken

Spring rolls

Chips

Take away Chinese meal

Meat pies

Sausage rolls

worksheet

Fat science

This activity looks at the fat content of everyday foods and sees how well tasting works as a measure of it.

What you need

- 5 or 6 different kinds of dairy foods, eg. different types of milk, cheese,butter. Make sure the packaging information includes fat content.
- Plates, glasses, a knife.

What to do

- Provide samples of all the foods without packaging. Number them to remember what they are.
- Discuss what people in the group know about fat.
- Ask students to arrange them in order of high fat to low fat (tasting is encouraged!).
- Check with the packaging.
- Discuss your results, how reliable was taste as a measure?

Follow on

- Role of fat in the diet and where it is found.
- Comparison of labels on foodstuffs.
- Visit to the supermarket.
- Alternatives to dairy products, different cultures' use of fat.

Margarine tasting

This activity uses and evaluates taste as a way of measuring fat content in margarine. It also introduces the idea of recording results on a chart.

What you need

Make up the following before the session so that students don't know what is in each one. Present them so that they look alike.

Margarine A
(1 teaspoon low fat margarine)
Margarine B
(1 teaspoon low salt margarine mixed with 1/2 teaspoon icing sugar)
Margarine C
(1 teaspoon low salt margarine)
Margarine D
(1 teaspoon regular margarine)

What to do

- Explain purpose of the activity and that you have made up some mixtures for tasting. Give each person a copy of the chart on the following worksheet and explain how to record results.

- Ask everyone to taste each mixture and mark what they think on the chart.

- Compare results and have a discussion, maybe using some of the following questions:

  - What did taste tell us?
  - What could we not judge with taste?
  - How much fat is there in margarine? (look at packets)
  - Is fat bad for you?
  - How can you find out?
  - Why is salt added to chips?
  - Why is sugar added to tomato sauce?
  - How much did people's taste differ?

Margarine tasting

Results chart

Tasting fat in margarine

Which tastes best?

Which has the most fat?

Which has the least fat?

Or are they the same?

Mixture	Tastes best	Most fat
Margarine A		
Margarine B		
Margarine C		
Margarine D		

Other comments?

Grease spot

This activity looks at the fat content of food through the 'grease spot' test and uses a chart to record results.

What you need

- Pieces of paper (Brown wrapping paper works well).
- And/or pieces of fabric.
- Various foods (eg. apple, potato, meat, cream, margarine).

What to do

- Guess which foods will leave a grease spot.
- Scrape or rub the foods on the paper or fabric.
- Label the marks and observe them.
- Leave to dry (5-10 minutes).
- Record which foods left a grease spot and which left a wet spot (make up a chart similar to that in **Margarine Tasting** worksheet)

Discuss

- How good a test of fat content is this?
- Did the results surprise you?

Measuring marge

The aim of this investigation is to raise awareness of margarine on bread as a source of fat in our diet while at the same time providing an opportunity for students to design their own method of investigation.

What you need

- Margarine.
- Measuring scales.
- Sliced bread.
- Teaspoons, knives.

What to do

- Start by telling students that dieticians say we are eating too much fat. Ask them where they think fat appears in our food. eg. fried food, meat, cakes and pastries, margarine, dairy foods, chocolate.
- Once we know where fat is we can start reducing it.
  Note we need some fat each day but not more than 12 teaspoons.
- Suggest that it may not be too difficult to find out how many teaspoons of margarine we eat each day on bread, or added to other food. Give some time for students to suggest ways.
- Some possible ways are:
  - Measuring how much margarine you put on a slice of bread.
  - Working out how long a container of margarine lasts.
  - Weighing out 100 grams margarine and seeing how many slices of bread can be spread.
- Ask students in pairs to decide their method of measurement, discuss it with you and then carry it out.
- Once everyone has made their measurements, use an average figure for a slice to decide how many teaspoons of margarine each person consumes in a day.
- Ask students: Why should we worry about fat?

- They will probably have heard stories about heart problems and becoming overweight from the media.

Note

There are a lot of kilojoules in margarine ie. fat.

1 slice bread 22g kj.
1 slice bread lightly spread with margarine 377 kj.
1 slice bread thickly spread with margarine 525 kj.

Less fat

Will reduce the risk of heart disease and help keep your weight down,

SO

1. Eat lean meats, like fish and chicken.
2. Trim off any fat.
3. Grill and bake on a rack instead of frying.
4. Cut down on greasy take-aways, pastries, butter, margarine, oil and cream.

Write down three things you could do to eat less fat.

1. _____
2. _____
3. _____

worksheet

A small fat quiz

Guess how many teaspoons of fat are in:

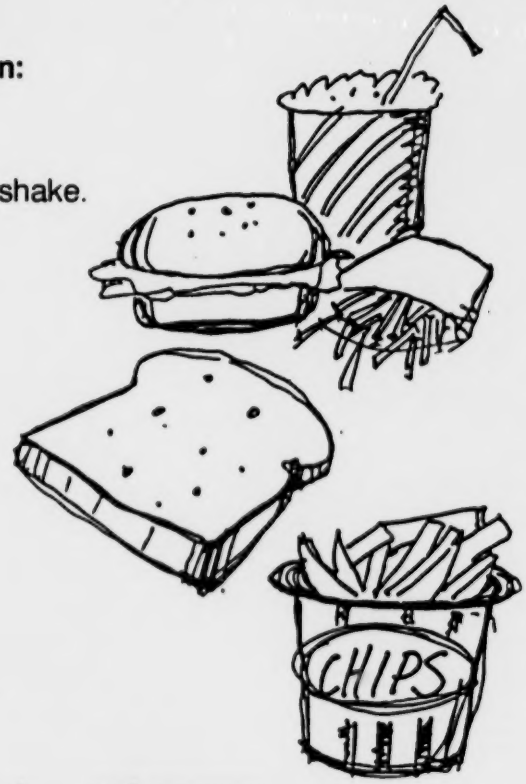
Big hamburger, chips and thickshake.

Slice of bread.

Serve of hot chips.

Large potato.

Small bar (100 g) of chocolate.



These are the answers, guess which goes with which.

(6, 0, 7, ¼ , 12)

Clue: Reverse the order of the numbers to get the answers ie. 12 hamburger etc.

worksheet

Breakfast science

This activity investigates the amount of sugar in breakfast cereals and tests out how good our senses are at measuring things.

What you need

- About 6 or 7 different sorts of breakfast cereals in their packets (try to include a low sugar one eg. *Vita Brits* and a high sugar one eg. *Honey Smacks*).
- Bowls to put them in.

What to do

- Put a small amount of cereal in each bowl and hide the packet.
- Ask the group to arrange the bowls in order of their sugar content. This can be done by:
  - guessing
  - looking
  - tasting
  - what you know already
  - discussing.
- If people have guessed the names of some cereals they could label them.
- Show the packets and ask the group to stand each one behind its bowl.
- Discuss information provided on the packet, find where it states the sugar content (usually per 100 gms). Arrange packets in order of high to low sugar. Compare with the group's arrangement of bowls.

Discussion points

- What breakfast cereals people buy and why? Some reasons might be:
  - taste.
  - nutrition.
  - price.
  - children's influence.
  - appearance.
- How reliable was taste as a measure of sugar? How much did people's tastes vary? Taste-bud conditioning?

- Why are we told to cut down on sugar?
- Many people don't eat packaged cereals for breakfast.
- What other things can you eat?

Follow on

- Using scales weigh out of equivalent amount of sugar to demonstrate how much there is.
- Percentages (from information on packets).
- Cost comparisons.
- Role of advertising. Which cereals are aimed at children? Are they high or low in sugar?
- Making a muesli mix from a recipe (find out sugar content of dried fruit).

Taste test - how sweet it is

This is another activity which uses and evaluates taste as a way of measuring sugar content in food and also records results in chart form.

What you need

- Make up the following before the session. Present them so they look the same.

Honey solution A
(1 teaspoon honey and 1 teaspoon water.)

Honey solution B
(1 teaspoon honey, 1 tablespoon water and 1/2 teaspoon lemon juice).

- Make up enough solutions for the numbers in the group – keeping proportions the same
- Teaspoons for tasting.

What to do

- Explain to the group that you have made up some mixtures for tasting.
- When tasting they should decide which tastes best – honey A or honey B.
- At the same time they should decide from tasting which has more honey, A or B or are they the same?
- Fill in the 'Taste Test' chart.
- After each person has completed their results, have a discussion:
  - What did taste tell us?
  - What couldn't we judge with taste?

Follow on

- Australians eat about 28 teaspoons of sugar per day – three quarters of it in processed food.
- Food with a lot of sugar in it is not always very sweet to taste, eg. some health food bars are 50% sugar.
- Is sugar bad for you? Why? Collect labels off packets and cans, both sweet and savoury foods and see how many contain sugar using all the names eg. glucose, sucrose, fructose, honey, lactose, corn syrup.
- Also note the order of ingredients. The first named being the largest and so on.
- The main ingredients of chocolate are fat and sugar. What other foods contain both fat and sugar together?
- Read and complete the **Less Sugar** worksheet following.

Note

The term 'sugar' here refers to total sugars. Common sugar is 99.9% sucrose whereas honey is 2% sucrose, 34% glucose and 40% fructose, 19% water. Glucose, sucrose and fructose are closely related chemically, are sweet and contribute the same kilojoules.

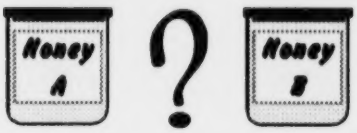
Taste test chart

Which tastes best?

Which has most honey?

	Tastes best	Most honey
Honey A		
Honey B		

Other comments.



Less sugar

Will help prevent tooth decay and help keep weight down,

SO

1. Eat fruit instead of lollies or chocolate bars for snacks.
2. Drink water instead of soft drinks or fruit juices.
3. Cut down on cakes, biscuits and jams.
4. Gradually cut out adding sugar to tea and coffee.

Write down three ways you could cut down on sugar.

1. _____
2. _____
3. _____

worksheet

Chocolates, apples and advertising

This activity helps to focus on the good things about different foods, and on the aims and effects of advertising.

What you need

- Paper, coloured pens or textas.
- Apples.
- Chocolate.

What to do

Divide into 2 groups. Each makes up an advertisement – one for chocolate, the other for apples. It may help to brainstorm descriptions of both first. Eat some to get started!

Some helpful facts

Apple

308 kj – same as 20 g chocolate.
No fat, no protein.
High in fibre.
Vitamins and minerals.
Second favourite fruit after oranges in Australia.
Cleans out the mouth with food acid.
Available all year.

Chocolate

Comforting.
Special – given as presents.
High in fat and sugar.
Concentrated food.
No fibre, no bulk.
Easy to eat.
Clears from the mouth quicker than some other sweets.

Food pyramid

The aim here is to build a picture of what dieticians say we should be eating.

What you need

- Large piece of paper to draw a pyramid on.
- Magazines to cut out pictures of food.
- Scissors, glue.

What to do

- Read the list of how much of different foods we should eat.
- Draw a pyramid on the large sheet of paper (see following page).
- Cut and paste on pictures in appropriate sections. (Decide if you want food for one meal or one day - choose about one serve of each. Don't allow overlap outside triangle.)

Eat least

Butter.
Margarine.
Oil.
Sugar.

Eat moderately

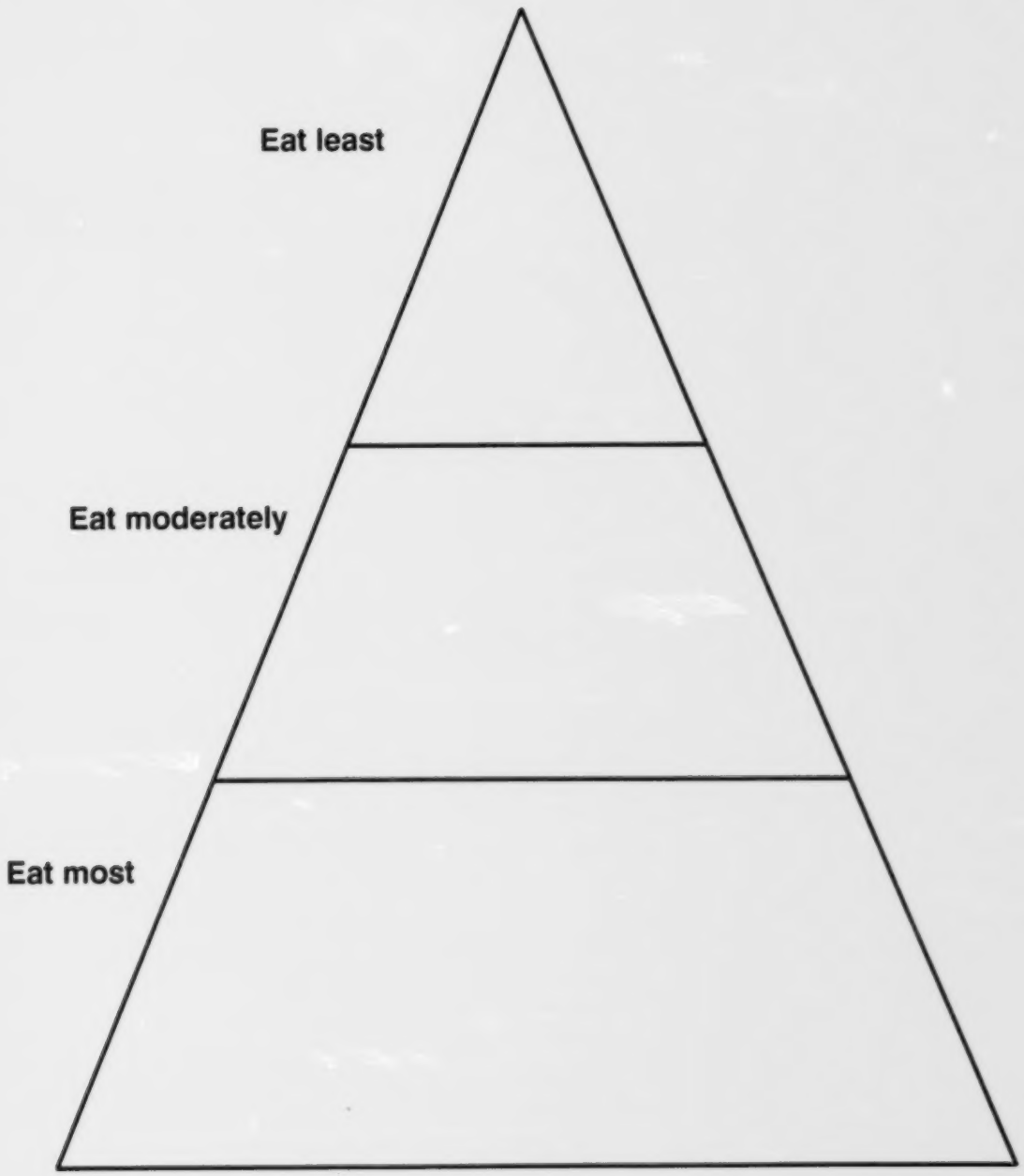
Lean meat.
Chicken.
Fish.
Dried beans and lentils.
Yoghurt.
Eggs
Nuts
Milk
Cheese

Eat most

Breads.
Cereals.
Grains.
Pasta.
Vegetables
Fruits

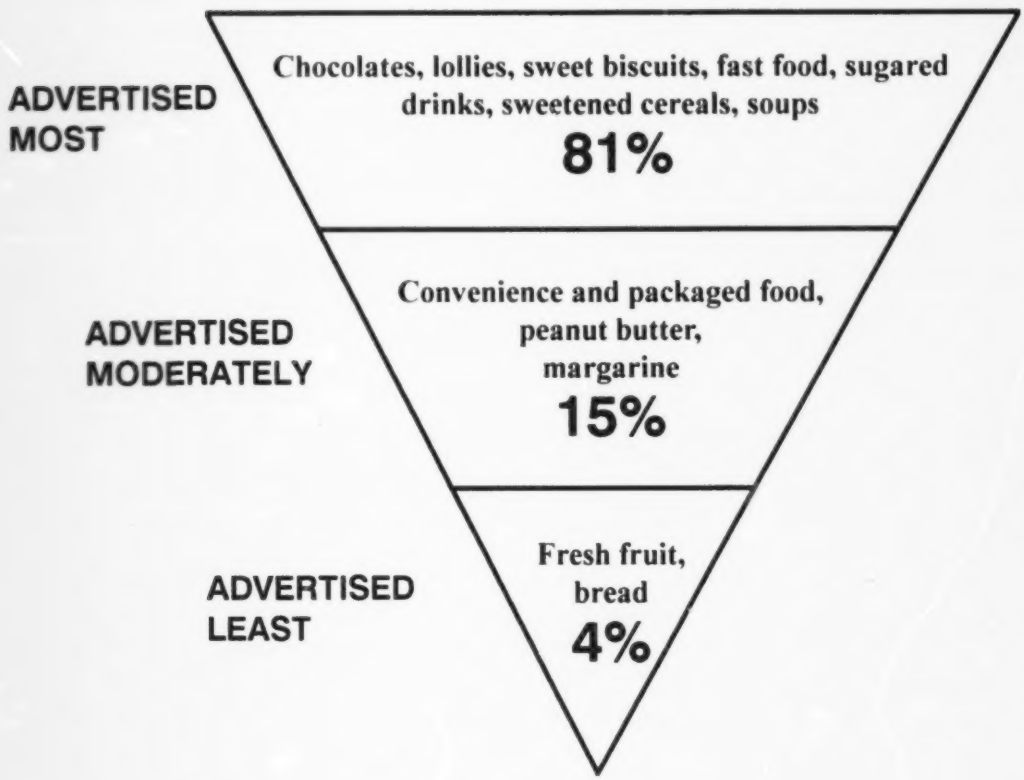
Food pyramid

What should we be eating?



Television food advertising

- A survey (Choice - Oct 1990) of TV advertisements shown during after-school hours (3.30 - 6.00 p.m.) counted 941 ads. over 5 days.
- 276 (more than 30%) of these were for food products.
- Counting up the different ads, the researchers found their results looked like this:



What to do

- Compare this with the food pyramid in the previous activity.
- Some questions to discuss:
  - What messages do you think children get from adverts?
  - Are children more affected by advertising?
  - Why is it more important for children to have a healthy diet?
- Read the letter to the Prime Minister on the next page and write your own if you agree.
- Do your own survey of TV ads for children. (see following pages).
- Write to the TV networks.
- Write to the food companies.

Letter to the Prime Minister

ADDRESS

Prime Minister
Parliament House
CANBERRA ACT 2600

Dear Prime Minister

I am writing to you because I am worried about the way food is being advertised to children.

What we eat now affects our health in years to come. Bad habits start while we are very young. For this reason, your Government supports health education that encourages Australians to eat lots of fresh fruit, vegetables and cereals, a lesser amount of meat and dairy products and a very small amount of foods high in fat, salt and sugar.

TV advertising to children gives a different message. Nearly 80% of food advertising pushed fatty snacks or sweets - the very foods that should be eaten least. Also, these ads take up most of the advertising time. This must be stopped.

For the hours when children are the main audience, TV advertising of foods must be made to help children understand about a healthy diet.

Yours sincerely,

Television food advertising

Do your own survey of TV ads

Question 1: What food ads are being shown to children?

Make a list of the food products being advertised especially between 3.30 and 6.00 p.m. Ask your family or friends to help.

Question 2: Which are good for you?

Classify the food products advertised as:

A **Foods you should eat least** - i.e. high fat, sugary, salty snacks and drinks and sweets.
B **Foods you can eat more of** - i.e. lean meat and dairy products.
C **Foods you should eat most of** - i.e. fresh fruits, vegetables, whole grain breads and cereals.

You may need to examine packets in the shops to see what some contain. For example, many breakfast cereals have added sugar and some are high in fat. Discuss those you are not sure about.

Question 3: Which are advertised most?

The survey forms have a box for your results. Fill in:

- The number of food products in Category A.
- The number of food products in Category C.
- The total number of repeats for all the products in Category A.
- The total number of repeats for all the products in Category C

Survey of TV ads

Channel/Network _____

Food Ads on this Network watched by children	Category (A,B or C)	Number of Repeats

Use more paper if necessary.

Summary of Results for TV Network/Channel

	No. of Food Ads	Total number of repeats
In Category A		
In Category C		

Adapted from material by the Australian Consumers Association Food Campaign.

worksheet

Who needs most food?

This is a game which helps to discuss the energy and food needs of different activities.

What you need

- Enough copies of the following page so that people can work individually or in small groups.

What to do

- Cut up the pictures and put in order of who needs most energy.
- Where does energy come from? – Food.
- Suggest a dinner for each person.
- If their meals got mixed up or they all had the same, what would happen?

Note

All this should lead to:

To lose weight you change the type of food you eat (less fat and sugar) and do more exercise.

Who needs most food?

Watching TV

Walking

Cleaning

Typing

Jogging

Sleeping

Swimming

worksheet

50

Who needs most food?

Answers

Watching TV

Walking

Cleaning

Typing

Jogging

Sleeping

Swimming

worksheet

Have a guess

This is an enjoyable activity that gets people moving around while thinking and talking about issues to do with food and health.

What you need

- **Have a guess** worksheets.
- Scissors, sticky tape.
- Knowledge of percentages (or adapt material).

What to do

- Copy and cut out the questions on the next page.
- **Either**:
  Sticky tape a question to each person's back. Everyone then walks around the room and collects answers to their question from other people in the group. They can then report on the range of their answers and the correct one can be given and discussed.

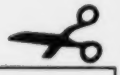
  Or:
  Each person in the group is given a question which they read to the others. Answers are noted and the correct one offered for discussion.

Follow On

- See rest of this section, especially **Television food advertising.**

Have a guess

Questions



1. What percentage of children in Australia have high cholesterol levels? Choose from:
   2%, 10%, 20%, 50%.

2. What percentage of children in Australia are overweight? Choose from:
   5%, 15%, 30%, 50%.

3. What percentage of all deaths in Australia are to do with what people eat? Choose from:
   10%, 20%, 40%, 60%.

4. How much government money is spent each year on education about food and diet? Choose from:
   Half million dollars, 1 million dollars, 2 million dollars, 3 million dollars.

5. How much does the Australian food industry spend each day on advertising? Choose from:
   $100,000; $300,000; $500,000; $1,000,000.

6. What percentage of men in Australia are overweight? Choose from:
   10%, 23%, 35%, 43%.

7. What percentage of women in Australia are overweight? Choose from:
   10%, 23%, 35%, 43%.

worksheet

Have a guess

Answers:

1. 50%
2. 30%
3. 60%
4. $1,000,000
5. $500,000 (Source: Choice Oct. 1990)
6. 43%
7. 35% (Source Anti-Cancer Council)

Note

- If people are unfamiliar with percentages, questions can be phrased differently and answers given in terms of half, bit more than a quarter, over half etc.

What are we eating?

Here are some activities which look at the issue of additives in food.

What you need

- Some labels and packaging from processed foods.
- Copy of the next page.

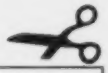
What to do

- Copy the next page, and cut the boxes out.to make cards.
- Have a look at the labels from processed foodstuffs.
- Discuss what additives are and see which foods have them.
- Shuffle and deal out the cards then:

Choose from these activities:

- Everyone reads their card and asks questions about it and/or explains it in their own words.
- Work in pairs to read, discuss and question.
- With one person reading out their card as a starting point, have a discussion where everyone tries to say what's on their card at an appropriate point. People can work in pairs to help each other.
- People arrange themselves or the cards in two groups – for and against additives/processed food.
- Everyone writes their own opinion on a piece of card or paper. Shuffle them up, deal them out and take turns in reading them to the group.

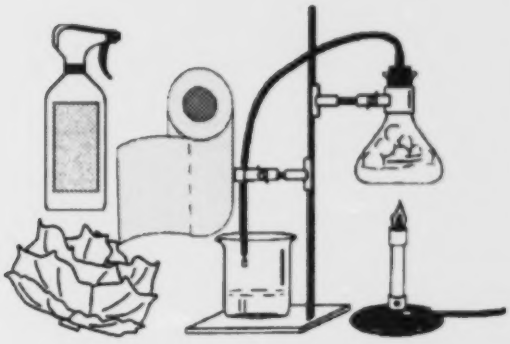
What are we eating



Everyone in my family is too busy to make everything we eat from fresh stuff.	Babies and small children can have very bad reactions to additives
We don't need additives. They're mainly in processed foods which are bad for us anyway	Most of my favourite foods have got them in and I'm OK, so I don't see what all the fuss is about.
Only very few people have bad reactions to additives. Those people will soon find out what they can't eat.	Not everyone has fridges and freezers. These chemicals mean people can keep food and not cook everyday. Tinned foods are very convenient.
We don't know much about these chemicals. We should try not to use them because we may find out more in five or ten years. We should avoid eating them.	Food from large factories contain lots of additives. The manufacturers only put them in so they can make the food last and make more profits.
All foods are chemicals anyway.	

Adapted from: ***Science in Process****, Inner London Education Authority.Published by Heinemann*

2. Cabbages, cleaning and chemistry



This section has a number of activities which use common and household substances to show how chemistry is a part of everyday life.

Cabbages, cleaning and chemistry: background reading

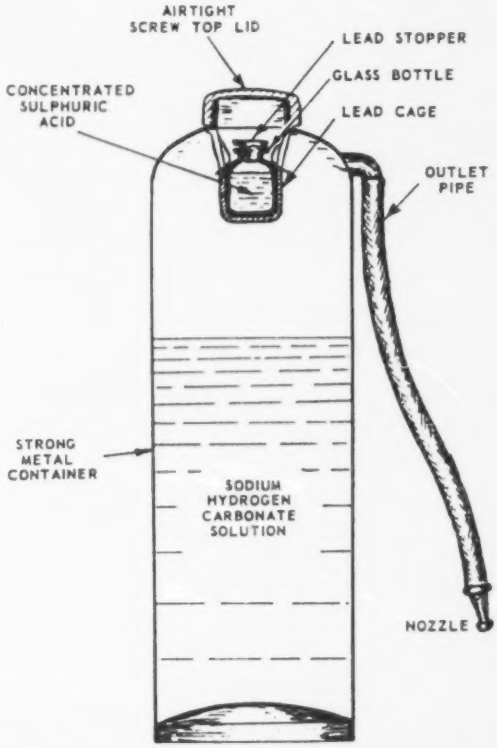
The gas carbon dioxide (CO_2)

All gases expand when they are heated. This is why tyre pressure can vary from a lower level on a cold morning to a higher level later in the day. Heating gas is the way a hot air balloon works ; when the balloon needs to descend the heater is turned off.

If a cooking mixture contains bubbles of gas, these too, will expand when the mixture is cooked. This causes the mixture to "rise". The gas used in cooking is usually carbon dioxide as it is safe and easily produced.

The tiny yeast organisms produce carbon dioxide when fed with sugar. The gas produced makes bread rise. Carbon dioxide can also be made by mixing substances together. A common combination is mixing acid with a bicarbonate as when cream of tartar (scientific name tartaric acid) is added to baking soda (scientific name sodium bicarbonate) . Baking powder is a dry mixture of these two substances. The reaction only takes place in a liquid.

ENO is a dry mixture of sodium bicarbonate, tartaric acid and citric acid, which can be stored for a long time.Only when water is added do the bubbles of carbon dioxide appear. See the diagram to see how the CO_2 fire extinguisher works.



Acids and alkalis

Acids and alkalis are two types of substances, which have certain chemical qualities, but which when added together cancel out these qualities in each other.

An acid is a substance which contains hydrogen (H) and so the term **pH** is used to denote acidity. The lower the pH, the more acidic a substance is :

- pH less than 7 is acidic
- pH equal to 7 is neutral
- pH more than 7 is alkaline

Blood has a pH of 7.4, milk of 6.4, seawater 8.5, softdrinks 2.9.

Substances called indicators are used to detect acids and alkalis. An indicator changes colour if placed in an acid and changes again if placed in the presence of an alkali.

An example of this is litmus paper ('the litmus test'): litmus is red in an acid, blue in an alkakli. Universal indicator shows a graduation of colour according to pH and is the one used in soil test kits. Plant pigments are sometimes indicators and hydrangeas show this clearly. Blue flowers show that the soil is acidic and pink flowers show alkalinity in the soil.

Acids are important in many facets of our society: sulphuric acid (often called vitriol) and hydrochloric acid (or spirits of salts) are both important industrial compounds and acetic acid (vinegar) is a widely used preservative.

It is acids which give foods a 'sharp' taste :

- acetic acid in vinegar
- citric acid in lemons, oranges, grapefruit
- malic acid in green unripe apples
- oxalic acid in rhubarblactic acid in sour milk

It is the acid in lemon juice which causes a cut to sting when the juice touches it.

Alkalis have a bitter taste and a slippery feel. Alkalis are associated with cleaning products. Sodium hydroxide (caustic soda) is used in industry but also for unblocking drains, as a detergent for dishwashers and as an oven cleaner. Potassium hydroxide is used to make soft soaps, calcium hydroxide (slaked lime) is used in cements and bleaches and ammonium hydroxide (ammonia) is an effective cleaner.

An antbite stings because formic acid is injected into the skin. A paste made of baking soda and water can ease the pain by neutralising the acid. An "antacid" tablet neutralises the acid leaking out of the stomach causing "heartburn".

The pH levels change along the digestive system to help each of the different processes which occur. The stomach is very acidic but becomes alkaline when bile is added in the small intestine (see Background notes for "Food For Thought"). Human skin is slightly acidic and this helps to kill bacteria. Soap and detergents are both alkaline substances.

The pH of the soil can affect plants' growth; azaleas like acidic soils, vegetables prefer more alkaline soils. Sometimes the pH of the soil stops a plant absorbing some needed minerals.

Corrosion

Iron reacts with oxygen in the air and water to form iron oxide (rust). This is a costly reaction for metal structures like ships, bridges and cars. Painting is the most common form of protection used.

Chromium, nickel, gold, enamel, plastic, cement are some products which don't corrode easily and are used to coat iron or steel. Sea water is even more corrosive than fresh water and ship hulls are painted with a red-lead paint. Silver is another metal which reacts with the air and discolours.

Cooking chemistry

This unit looks at how baking soda works in cooking.

What you need

- A cake.
- A packet of cake mixture.
- Frypan.
- Plain flour.
- Baking soda.
- Water.
- Butter/margarine.
- Mixing bowl.
- Spatula.
- Stove or other safe heat source.

What to do

- Cut the cake and pass around slices. Before they get eaten, ask the group to look carefully at the cake and say what it looks like.
- Write down all comments.
- Ask for other ways to describe the cake (smell? taste?) and list comments.
- From above, someone may have noticed small holes in the cake, if not, point them out.
- Ask where the small holes come from and what cake mixture looks like before it is cooked. (Mix one up to have a look.)

- Make two separate pancake mixtures:

1.	Mix ½ cup of plain flour with water to make a paste.
2.	As above but add a teaspoon of baking soda.

- Do you see any differences in the mixtures before cooking? Look carefully.
- Melt margarine or butter in frypan. Cook each pancake separately on both sides until golden brown.
- What differences (if any) can you see?
- What differences did you notice during the cooking?
- After cutting the pancakes in half, how do the thicknesses compare? Are there holes present?
- Which pancake had the holes? Where did they come from?

Note

- Baking soda produces gas bubbles when heated.
- Look at the pack; it may be labelled 'Bicarbonate of Soda'. Baking soda is a chemical substance called sodium bicarbonate. When heated it produces a gas called carbon dioxide.

Follow on

- Try milk instead of water in the mixture.
- If the term carbon dioxide is introduced, discuss what it is and what people know about it. Also have a look at the **Hubble bubble whoosh** unit. Greenhouse effect may come up here. (See **References and resources** section).
- Other chemical processes in the kitchen: —
  - *dissolving of substances*
  - *heating substances to form liquids (eg. butter)*
  - *cooking vegetables*

- What is self-raising flour?
  - *(plain flour with baking powder added)*
- What would make these pancakes more edible?
- What other foods have holes, or not?
  - *(maybe compare different breads - wholemeal loaf, Greek and Lebanese flat bread, Mountain bread.)*
- Writing a description of what happened.
- Other 'science' words people may have heard: brainstorm them: pool ideas about what they mean.
- Matching game: 'scientific' word with its meaning.
- Write up the experiment in single sentences. Cut up and reorder.

Hubble bubble whoosh

This unit introduces the idea of a chemical reaction through everyday items.

What you need

- A glass.
- Water.
- Vinegar.
- Baking soda.
- Matches.

What to do

- Half - fill your glass with water.
- Put a dash of vinegar in your glass.
- Place one spoon of baking soda in the glass. You should get quite a startling result.
- Light a match. Place it above the glass. What happens to the match?

Note

The match should go out because carbon dioxide gas is produced and a match needs oxygen to burn.

Follow on

- One practical application of this is the CO_2 fire extinguisher.

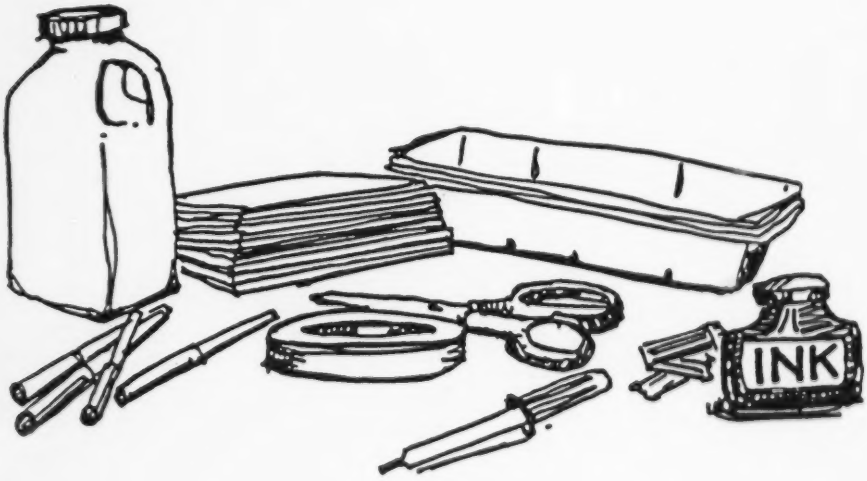
Adapted from: Family Science Activities Kit, Melbourne.

Separation science

The aim here is to separate the dye colours in ink.

What you need

- Small jars (eg. baby food jars), cups, glasses or a water trough as shown. All you need is a way to suspend strips of paper so the ends hang in the water.
- Filter papers (coffee filter papers, blotting paper from newsagents or white institutional paper towels also work).
- Blue or black ink.
- A number of water soluble coloured felt pens.
- A dropper.
- Water.
- Scissors.
- Masking tape.



What to do

- Cut the filter paper into rectangles of a size suitable for your water container.
- Put water in the container to a depth less than 1cm.

- Make as small a dot as you can with the dropper and ink about 2cms above the edge of the paper. (The smaller the dot the better this works)

- Attach the top of the strip to a pencil with masking tape and gently lower the strip into the water container. Make sure the dot is at least 1cm above the water line.

- Repeat with the other pens and leave until the water has run almost to the edge. (The ink one will take longest).

- Take the papers out and see what has happened. Leaving them to dry may reveal other things.

Note

The inks in pens are often mixtures of different colors which are dissolved in liquid. When you write, the liquid dries and leaves the colour behind. In this activity, when the water creeps up the strip and meets the dried colour, it dissoves it and carries it along. As the inks are a mixture of different colours which get carried along at different rates, they separate out into bands of colour. This colour separation process is called chromatography (colour writing).

Often separations of very small substances may be needed, for example:

- Forensic scientists may need to study small pieces of evidence at the scene of a crime.
- Manufacturers of dyes for materials or sweets need to obtain certain specific colours or combinations.
- Chemists may need to test a drug or liquid mixure to see what's in it.

Follow on

- Some pens (eg. biros) will not be dissolved by water (as we notice when we try to wash clothes with biro marks). We need to add something like **Preen** to dissolve biro marks.

- Repeat the experiment using ballpoint pens instead of ink and methylated spirit instead of water.

- List as many everyday separations the group can think of:
  eg
  - draining rice with a colander
  - coffee grains and water with filter paper
  - metal detectors
  - water filters
  - filters in cars (oil, air)
  - panning for gold!

66

- Separate is a word that people often find tricky to spell. It may help to remember:

  "The 'e's are separated by the 'a's".
  or
  "There's a rat in sep a rat e"

- Have a look at the unit **What colour is white?** for separating the colours in white light.

A Puzzle

- Present the group with a tray of earth or sand mixed with some pins. Ask for ideas how to separate the pins from the soil. (a magnet? a sieve?)

An orange a day.....

This unit tries to find out just how much vitamin C you are really getting from different orange drinks. It also gives some information about vitamin C and offers practice in testing, measuring, recording results and report writing.

What you need

- Known food sources of vitamin C such as fresh squeezed orange juice, commercial orange juice (in carton, clear container, can), an orange flavoured fruit drink, maybe Ribena for comparison.
- Boiling water.
- Cornflour.
- Iodine. (You can buy 100 ml. of iodine solution very cheaply from chemists).
- Drinking glasses.
- An eyedropper.

What to do

- Pool ideas about vitamin C, where it's found, why we need it and so on.
- Ask how much vitamin C there is in the different orange drinks. People might like to guess which has most or least.
- Prepare vitamin C indicator. Stir 5 ml (1 tsp) of cornflour into a cup (250 ml) of boiling water. Add iodine drop by drop until the solution turns blue. This is the iodine indicator. (It indicates or shows something).
- Using the same amount of indicator each time (standard amount, say 10 ml or 2 teaspoons, add juice drop by drop (using clean eyedropper) until the blue colour just disappears. Count the number of drops of juice needed to lose the blue colour.
- Do the test again with other samples.
- Make a table of the number of drops required to make the blue colour disappear. The more vitamin C in a sample, the less number of drops needed to remove the colour.

- Compare results and place them in descending vitamin C content order.

This test is not an absolute measure of vitamin C content but is very useful for comparing things.

Note

Vitamin C is one of a group of substances that help control the chemical processes of the body. Vitamins appear in small amounts in a wide variety of foods, and are only needed in small amounts in the diet.

When the chemicals which were later called vitamins were first discovered, they were given the letters of the alphabet as their chemical composition was not known. These letters have tended to stick although the chemical formulae and names are now understood, e.g., vitamin C is also called ascorbic acid.

The role of vitamins is to regulate the chemical reactions taking place in the body. Generally vitamin C keeps the body healthy by helping it to resist infection, aiding growth of strong bones and teeth and maintaining healthy gums and blood vessels. Vitamin C is also an important ingredient in the wound healing process in the body.

Vitamin C is a water soluble vitamin (dissolves in water). Because the body cannot store it, it needs to be supplied daily.

Vitamin C appears in a wide range of raw fruit and vegetables. It is easily destroyed by various methods of preparing and cooking food such as:

- cooking water - because it is water soluble, much is usually lost when cooking water is drained.
- light and oxygen - prolonged exposure to light destroys vitamin C, e.g., cut fruit and vegetables lose vitamin C content if prepared some time in advance.
- heat - avoid prolonged heating; don't overcook vegetables.

The Daily Required Amount (by the average adult) is 45-60 mg. If you eat a well balanced diet each day this is easily attainable!

The main sources are:

Richest sources

- kiwifruit, guavas, blackcurrents, parsley, capsicums.

Good sources

- strawberries, pawpaw, tamarillos, oranges, lemons, grapefruit, pineapples,cabbage, brussel sprouts, spinach, silverbeet, asparagus, cauliflower, broccoli, peas.

Follow on

- Try heating the orange juice and then do the test again.
  Is the vitamin C content different?
- Write a short report on what you have found out about vitamin C.
- If you have reference books available, look up ***scurvy*** and also see if you can find information about vitamin C and the common cold.
- Have a look at **Food for Thought** for more work on nutrition, and **Of Cabbages and Chemistry** for other work with an ***indicator.***

Of cabbages and chemistry

This activity is a colourful test which introduces acids and bases through everyday household substances.

What you need

- Red cabbage leaves.
- Saucepan.
- Water.
- Safe heat source eg cooker ring.
- 1 large jar to collect liquid.
- 6 - 8 small jars (depending on number of things you want to test).
- Small amount of various household substances (e.g washing soda crystals, cleaning liquid, soap, lemon juice, baking soda, Alka Seltzer, shampoo, dishwashing liquid, white vinegar).

Note

Colourless substances are best so that colour changes are not difficult to detect.

What to do

- Chop up some red cabbage leaves and boil in a saucepan of water for about 5 mins. Allow the saucepan to cool and pour off the coloured cabbage water into a jar.
- Take three clean jars. Squeeze the juice from a lemon into one of them, add water until the jar is half full, and stir. Pour water into the second jar until half full. In the third jar put half a teaspoon of baking soda, add water until the jar is half full and stir until it dissolves.
- Line up the jars, pour a little cabbage water into each one and watch the colour changes. The lemon water goes pink or red, the plain water goes violet and the baking soda turns green.

The red water

(lemon juice)

The sour taste of unripe fruit, vinegar or lemons is due to chemicals called acids. People may have an impression of acids as liquids which can burn. While some acids are dangerous and need to be handled carefully, others are quite harmless and can even be found in food. Here the cabbage water turns red or pink when added to acid. Substances like this that change colour to show the presence of a chemical are called INDICATORS because they indicate or show what is there.

The violet water

(plain water)

The violet cabbage water mixed with the plain water with no great change in colour so no acid is shown.

The green water

(baking soda)

The baking soda solution is called a ***base*** - the chemical opposite of acid. To show this, add some red cabbage water to some more lemon water and them add about a teaspoon of baking soda. Keep on adding baking soda until you see the colour changing from red through violet to green. When the colour is violet, it is neutral, neither acid nor base. (This is how indigestion tablets work, neutralising too much acid in the stomach).

Bases are sometimes called alkalis. They are used in most household cleaners. Soap is a weak base. Red cabbage water turns bases green.

- On a piece of paper draw columns as shown below and write up the things you have tested so far.

Substance	colour of red cabbage water	acid	neutral	base
lemon juice	red	✓		
plain water	violet		✓	
baking soda	green			✓

- Continue by testing other substances and recording your results. Don't handle anything you test unless you know it is safe. If you test tablet powders, crystals or other solids, dissolve them in water first. Record your results on your chart.

Follow on

- Some other vegetables can be used instead of red cabbage. Try beetroot juice.

- Some shampoos claim to be pH balanced. People may have heard the expression in relation to soil testing, pools etc. It can be introduced as a term used to describe levels of acids and bases.

pH levels		
0	7	14
acid	neutral	basic

pH is the symbol for **Hydrogen present**. Hydrogen is responsible for acidity levels.

- People may have heard of Acid Rain. Sulfur dioxide gas builds up in the atmosphere from burning of fossil fuels. The gas then turns to sulfuric acid when it combines with water in the atmosphere and dissolves in rainwater, falling as acid rain. (More information from environmental groups - see Resources).

- First Aid - look up treatment of chemical burns in a First Aid manual.

Making a skin cleanser

This unit shows you how to make a cream which is the base for commercial cleansing creams.

What You Need

- Containers for melting and mixing.
- Scales.
- Measuring jug.
- And, to make 100 gms (a standard tube size) of cream:
  - White beeswax 17gms
  - Liquid paraffin (by weight) 45gms
  - Borax 1gm
  - Water (boiled and cooled) 37gms or 37ml

  To give each participant 100gms to take away, multiply above amounts by the number of people in the group.
- Containers for the cream.

What to do

- Melt the beeswax with the liquid paraffin.
- Dissolve the Borax in the water.
- Add Borax solution to the melted oils.

The effect of adding the water and Borax to the oils is quite dramatic. A luxurious white cream forms immediately much to the delight of the makers.

Notes

You may have noticed that if you add oil to water then oil will float on top of the water. If you shake vigorously, the oil breaks up into small droplets and spreads for a short time through the water. However if you stop shaking, the small droplets move towards the surface and again form into larger and larger droplets until the oil floats on top again.

Detergents and other cleaning products work by helping oil and water to stay mixed so that grease (oil) can be removed. Creams and ointments are in fact a mixture of oil and water as the experiment has shown.

The Borax helps the oil and water to mix. It is used in small amounts compared to the oil and water. This additional ingredient needed to mix the oil and water is called a surfactant or surface active agent or an emulsifier. Other examples are soap, shampoos and detergents.

Why a Skin Cleanser?

The skin protects the body from the outside world, by enclosing it in an almost waterproof, flexible covering which keeps out harmful bacteria, potentially damaging sun's rays, dirt and grime etc. If we didn't have a skin we would suffer from extreme dehydration and heat loss (which, along with infection is the main cause of concern for burns victims). If we splash a droplet of water on our skin we see that it remains as a droplet: it does not spread out as water would if it is splashed on say a piece of cotton. This is because the skin produces an oily secretion (called sebum) which protects the surface of the skin by helping to keep it "moisturised" and therefore it doesn't "dry" out as readily. This substance has anti-bacterial and anti-fungal properties.

So, because the surface of our skin contains both water and oil we need a cleanser that will cleanse both the water and oil components of grime, but at the same time not remove too much of the protective oil. Therefore cleansers generally contain oil and water and a small amount of a substance which enables them to mix - not just in the bottle but also with the surface of the skin. Many people, of course, are happy with soap and water, or just water. Commercially produced cleansers and cosmetics can be very expensive. The cream you have just made is the base they use but perfume and colours are usually added.

Follow on

- Comparing ingredients and prices of commercial skin cleansers.

Cleaning up

Each year rust causes damage worth millions of dollars to metal objects like cars and boats. Rust is caused by a chemical process called oxidisation when oxygen and certain metals are combined.

This unit looks at ways of cleaning up objects that have rusted.

What you need

- a collection of different nails - some rusted and some new ones.
- jars.
- cola drinks, vinegar, baking soda, beer.

What to do

- Place the rusty nails in a series of jars. Fill these jars with different liquids you think may get rid of the rust. Try vinegar, a cola soft drink and some water with baking soda dissolved in it and any other suggestions from the group.
- Leave the nails in the jars for a few days. Which liquids cleaned up the nails?

Follow on

- Can you prevent rust from happening in the first place? Take some new nails and paint them with different substances that you think may prevent rust e.g Vaseline. Remember you are trying to stop oxygen combining with the metal. Place some coated and uncoated nails in a jar of water and leave them there for a few weeks. Then check the nails. Has any rust appeared? Which nails have rust appearing on them?
- Drop a number of old coins into various cola type drinks. Watch how the acid in the drinks cleans them up. What do you think happens in your stomach?

That's ripe

When you buy fruit from a shop, it isn't always ripe. This unit tests out two different ways of ripening green tomatoes.

What you need

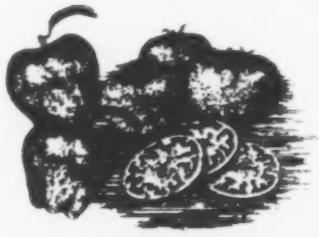
- Green tomatoes.
- Large paper bag.
- Apples.
- A few days and a dark cool place.

What to do

- Place some green tomatoes and an equal number of apples in a large paper bag.
- Keep the bag in a dark cool place.
- Check the bag every day to see if the tomatoes are turning red.
- Many people put green or unripe fruit on a window sill to ripen. Try out this way as well and see which is quickest.

Note

Apples give off a gas, called ethylene. This reacts with the tomatoes to produce sugars which ripen the fruit. That's why ripe tomatoes taste sweeter.



Adapted from: ***Science Fun*** *by Brian Mackness. Published by Shakespeare Head Press.*

Invisible Ink

This quick activity shows how lemon juice changes when it is heated. People may have written secret messages like this when they were young. They may like to do this with their own children.

What you need

- lemon juice.
- fine paintbrush.
- paper.
- lamp.

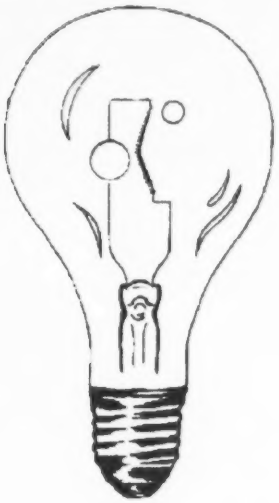
What to do

- With the paintbrush, write a message on the paper using plenty of lemon juice as ink.
- When the juice has dried, see if you can read the message.
- Turn on the lamp, hold the paper near the globe and move it back and forth.
- What do you notice?

Follow on

- People in the group could take turns in writing each other a 'secret message'.
- Make a list of other things that change when they are heated.
- See unit **From gassy to gooey to.....**

3. Seeing the light



As well as light, this section looks at sound, electricity and states of matter.

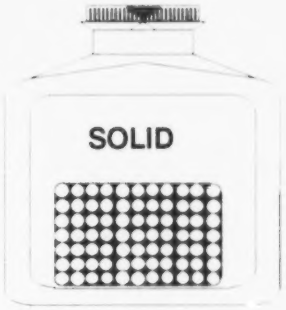
Seeing the light: background reading

Solids, liquids and gases

The three states of matter in which matter exists on the earth are called solids, liquids and gases.

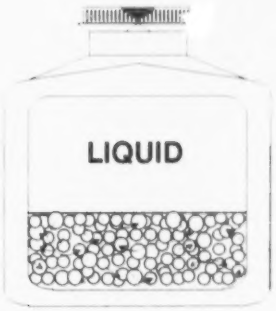
All types of matter (substances) are made up of tiny particles, so small they cannot even be seen with a microscope. The way these particles are packed together determines whether a substance is normally a solid, a liquid or a gas.

Solids



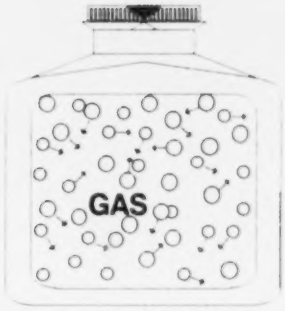
The particles are very tightly packed "shoulder to shoulder" in an ordered array. The only movement possible for the particles is a vibration. This is why solids hold their shape and don't "flow". The particles do not have much energy.

Liquids



The particles in liquid are still very close together but not in a regular arrangement. The particles slide around and over each other and have more energy and so move more than those in a solid. A liquid takes the shape of the bottom part of its container and its top surface is nearly horizontal.

Gases



In a gas the particles are constantly moving. The particles are constantly hitting the sides of the gas' container and so the volume of the gas is only limited by the size of its container. A gas will "fill" its container.

Change of state

A substance can change from one state of matter to another, eg. from solid to liquid or liquid to gas, if the energy which the particles possess is increased or decreased. This usually occurs by heating (adding energy to) a substance or cooling (removing energy from) a substance.

Melting

If a solid is heated, the particles gain energy and vibrate more energetically. If they gain enough energy the particles can "break out" of their ordered arrangement. The particles can now slide around, the substance flows and is now in a liquid state. eg. ice melting

Evaporation

If enough heat energy is added to a liquid the particles move around more quickly and the particles actually escape from the surface of the liquid. The particles can then move independently and a gas is formed. eg. water liquid changing to steam

Condensation

If a gas is cooled, the particles slow down and if they lose enough energy they will "clump together" and not move far from other particles. The substance is now a liquid. eg. steam hitting a cold mirror and condensing into small droplets of water.

Freezing

When a liquid is cooled, the particles move so slowly that they can be "trapped" in a network of other particles. The only movement is a vibration and so the liquid has become a solid. eg. water put into a freezer where it turns into ice

Light

The white (ordinary) light we see is actually made up of all the colours of the rainbow. Sir Isaac Newton was the first one to show this. When our eyes 'see' all the different colours together it cannot distinguish the different colours and sees only white light. If you spin the colour wheel you discover you can no longer see all the different colours, just white.

When light goes from one medium to another eg. from glass to air, from air to water, the light changes speed and so seems to bend. The different colours are affected to differing degrees - some bend more than others and so white light separates into its constituent colours. So you see rainbows in moist air, in pieces of glass or a slick of oil.

If white light is shone on a red object then the object absorbs most of the coloured light but reflects or bounces off the red light and so the object looks red. Similarly blue objects reflect blue light.

Sound

Sound is caused by particles in a substance vibrating. When the vibration reaches our ears we hear a sound. If a rubber band is flicked, the energy from the flick is transfered to the particles in the rubber band and they vibrate. Air particles passing by are "bounced" by the particles of the rubber band. The air particles vibrate, bang into other air particles and pass on the energy. When a vibrating air particle enters the human ear, the vibration is transmitted through the parts of the ear and the message goes to the brain. The brain interprets this message as a sound.

On the moon we would ordinarily not hear any sounds as there are no air particles to bring the vibration to our ears. Only if we put our ears to a rock and banged it would we hear the noise made. In this case the vibrations would go straight from the rock through our bones to the innermost portion of the ear.

The faster the particles vibrate producing a sound, the higher the sound will be. A louder sound is made by more energy being put in and the particles vibrating a further distance.

From gassy to gooey to . .

This unit introduces the idea of solids, liquids and gases.

What you need

- Ice blocks.
- Saucepan.
- Source of heat, eg a stove.

What to do

Heat the ice blocks to produce first water then steam (water vapour). Ask the group for words that describe each stage (ice, water, steam).

Follow on

- Worksheet on **Solids liquids and gases**.
- Gassy and gooey game. (following)
- Put a lid on the saucepan to see the steam change back to water (condense).
- Vocabulary work

melting	-	**evaporating**
freezing	-	**condensing**

vapour	**gas**
liquid	**runny**
solid	**hard**

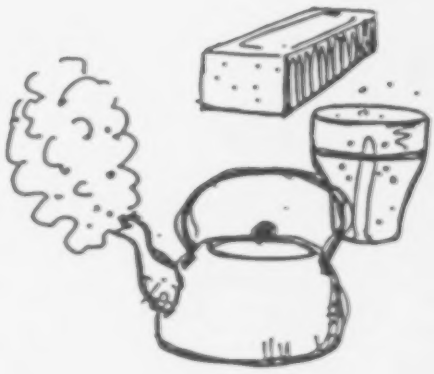
- Freezing and boiling points of water
- How a thermometer works.

Solids, liquids and gases

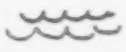
Solids have a shape of their own.

Liquids take the shape of their container.

Gases escape from their container very easily. They have no shape of their own.



Discuss and decide if each of the things below is a solid, liquid or gas.



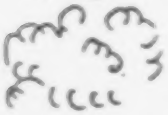
1. Water _____

2. Stone _____

3. Air _____

4. Milk. _____

5. Brick _____



6. Steam _____

7. Ice cream _____

8. Honey _____

worksheet

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Gassy and gooey game

This can be a discussion starter, or ice breaker or can act as an introduction to comparing and ordering things.

What you need

- A lot of different jars containing different substances eg water, air, smoke, jam, honey, flour, stones, nails, milk, beer, juice, rice, pasta, butter, wood, earth, grass etc, etc.

What you need

- If there are a lot of people in the group, give each one a sample and get them to sort themselves into a line from most solid to least solid (most gassy).
- A smaller group can arrange the jars in a similar line.

Follow on

- Which of the substances change when they are heated?
- Can the group think of anything that is not solid, liquid or gassy?
- Brainstorm and collect words to describe the substances.

Adapted from: ***Family Science Activities Kit,*** *Melbourne.*

What colour is white?

This unit looks at rainbows, colour and light.

What you need

- Coloured pencils.
- Prism (you can get plastic ones from toyshops — or try any solid lump of glass).
- Piece of white cardboard.
- Scissors.
- Colour wheel (homemade - see diagram).
- Electric drill.
- 3 torches.
- Some red, green and blue cellophane.
- Sheet of white paper.
- Sticky tape.

What to do

- Ask the group to imagine the last rainbow they saw. Draw and colour it.
- **Questions:**
  - How many colours are there? Name them (red, orange, yellow, green, blue, indigo, violet).
  - What do you know about rainbows?
  - Are they always the same?
  - Is your rainbow different from the person's next to you?
  - When do you see rainbows?
  - What would you like to know about rainbows?

- Demonstrate with any of the 3 following activities:
  - Cut a thin slit in the card. Hold a torch against the slit and shine a thin beam of light through. Put the prism in the path of the thin beam and shine the resulting image onto a white wall.What can you see?
  - Fix the colour wheel (containing preferably the 7 rainbow colours) onto the drill bit. Turn the drill on. (The wheel will appear white or greyish white).
  - Use sticky tape to stick red, green and blue cellophane over the front of the torches. Shine the three torches on the white paper. What colour did you get?
- Ask the group what they think all this might have to do with rainbows.

Note

- White light is a mixture of all the colours. When you shine a light through a prism you can see it divides the light into the seven colours of the rainbow: violet, indigo, blue, green, yellow, orange and red. The same thing happens when light passes through rain droplets, bending the light like a prism and making a rainbow.

  So when we turn on a light, making the white light come out of the globe or tube, we are actually seeing a mixture of colours which, to our eyes, looks white.

- The spectrum or rainbow colours can also be seen in soap bubbles or in puddles of oil on water. Blow some bubbles to demonstrate!

Seeing sound

Here are some activities to help people see that sound is a series of vibrations which travel through the air, water and other substances.

What you need

- Tuning fork, and something to strike it on like a rubber mat.
- small 200 ml. yoghurt pots.
- balloons.
- candle.
- glass of water.
- piece of polystyrene with a thread through it.
- matches.
- pin and pliers to hold it.

What to do

- Bang the end of the tuning fork on a rubber mat. Look at it closely. What do you see? Let's try to see this other ways:

- **Yoghurt Drum**

Make a small hole in the base of a small yoghurt pot with a hot pin (use the pliers to heat it in the candle flame). Cut off the neck of a balloon and pull the round part firmly over the top opening of the yoghurt pot making a drum with a small hole in its bottom. Put a lit candle approximately 30 cms from the small hole in the drum. What happens to the flame when you tap on the drum (balloon end)? What could this mean? Examine the drum more closely when you hit the balloon part. See if you can guess what might be happening.

- **Glass of water**

Bang the tuning fork on the rubber mat and just touch the water in the glass with it.
What does the water do?

- **Hanging by a thread**

  Bang the tuning fork on the mat again.
  Touch the piece of polystyrene which is hanging from a thread. What happens?

Note

- Sound is made by something moving to and fro (the balloon drum, the tuning fork). When something moves to and fro very fast it is **vibrating**. When the vibration stops, the sound stops.

- Write a description of each activity and what happened.

Follow on

- Participants may remember making a "telephone" when they were children with 2 cans and a long piece of string. The sound travels along the string. Try it out.

- Look at musical instruments e.g. piano or guitar to see strings vibrating when they are played.

- The speed of sound isn't as fast as light. Next time there is a storm, time the gap betwen the lightning and the thunder. Sound travels about 330 metres per second in air so you can tell how far away the storm is.

Everyday electricity

How much electricity do you use in your home? How could you cut down? This unit compares the amount of electricity used by everyday electrical appliances.

What you need

- Enough copies of page 74 for each person in the group. Cut them into strips and put them in envelopes.
- Some knowledge of decimals.

What to do

- Give each person an envelope.
- Ask the group to put the strips in the order of smallest to highest electricity consumption.

Note

Hair dryer	=	.1 kWh	
Stereo	=	.05 kWh	
Ironing	=	.5 kWh	
T.V	=	.5 kWh	
Fridge	=	1 kWh	Based on the times in the activity
Tumble dryer	=	2 kWh	
Light globe	=	.5 kWh	
Stove ring	=	1 kWh	
Fan heater	=	1 kWh	

Or, to introduce more maths and problem solving -

Hair dryer	-	60 minutes	=	.4 kWh
Stereo	-	60 minutes	=	.1 kWh
Ironing	-	60 minutes	=	.5 kWh
T.V	-	60 minutes	=	.2 kWh
Fridge	-	60 minutes	=	2 kWh
Tumble dryer	-	60 minutes	=	1 kWh
Light globe (100 watts)	-	60 minutes	=	.1 kWh
Stove ring	-	60 minutes	=	.5 kWh
Fan heater	-	60 minutes	=	1 kWh

Discuss results/surprises

Note

kWh = Kilowatt hours which is the amount of electricity it takes to run an appliance for one hour that draws one kilowatt. So amount of electricity in kWhs is the power in kilowatts multiplied by the time in hours.

1 kilowatt = 1,000 watts.

Follow on

- Bring in electricity bills to compare (some Melbourne suburbs have different prices).
- Write down all the electrical appliances in your home. (Have a look at them as they are often labelled with their power consumption. Some appliances have this as voltage and current, in which case the wattage is the voltage times the current.)
- Work out how much electriciy is used in a day at your home.
- List all the ways you could keep your electricity bill down. (See Resources section).

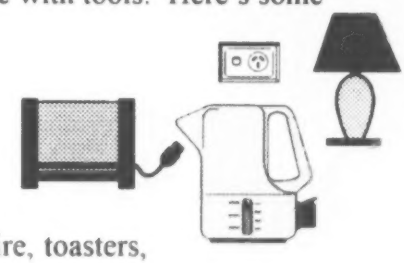
Adapted from: ***Science in Process****, Inner London Education Authority. Published by Heinemann.*

Everyday electricity

Using a hair dryer for 15 minutes
Playing a stereo for thirty minutes
Ironing for one hour
Watching TV for 3 hours
Running the fridge for 12 hours
Using the tumble dryer for 1 hour
Leaving a light globe on for 5 hours
Using one ring on the stove for an hour
Putting a fan heater on for 30 minutes

Tinkering

Lots of people find the workings of everyday electrical appliances quite mysterious. Many people have little experience with tools. Here's some practice with both.



What you need

- A number of unwanted but real electrical appliances eg. torches, fuses and fuse wire, toasters, hairdryers, electric jugs, lamps, plugs.
- Variety of tools for undoing and doing up eg. screwdrivers, pliers, spanners.

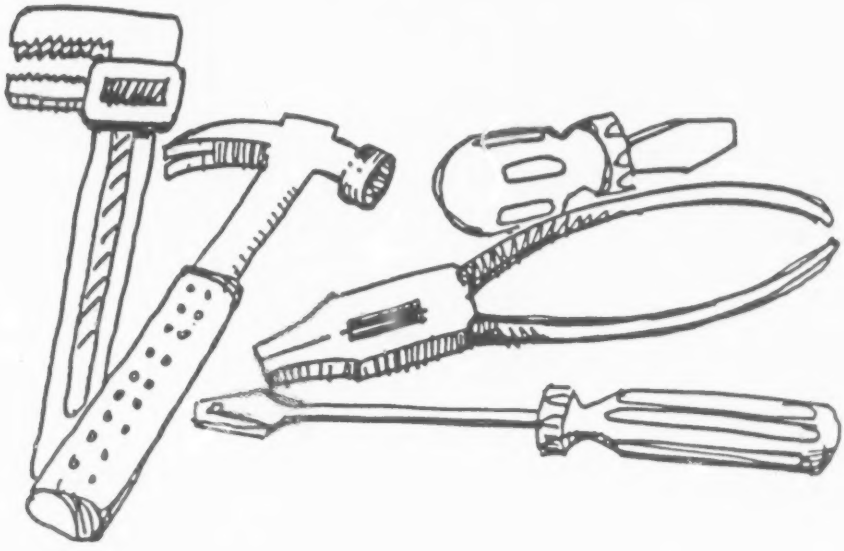
What to do

- Choose an object to take apart. (Some may prefer to work in pairs but make sure both have a turn with the tools).
- Take your object apart.
- As you do this, try to work out:
  - the bits that hold it together
  - the bits that make it work.
- Tell someone what you found out about the object and have a look to see what they have in common.
- Write about it, draw it with labels.
- Write about what you found out about using tools.

Follow on

- Other tools - ask students to list/draw as many as they can think of in 5 min. Collate and write down what they are used for.
- Fixing something.
- Making something.
- Car/bicycle maintenance course.

- Lego technics.
- Have a discussion about why many women are often not so confident with tools?
- Write about tools that you use. How and when did you learn how to use them? How would you teach someone else to use one of them? (There are lots of tools in most kitchens!)
- Tool matching exercise from *SPACES* (see **References and resources** section)



*Adapted from: '**Getting into Gear**' by McClintock Collective*

Torchlight

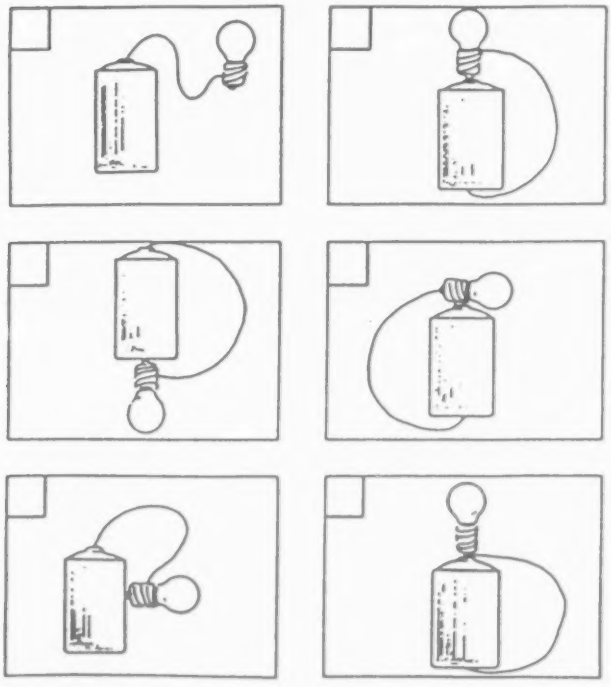
This unit looks at how a torch works and introduces the idea of a simple circuit.

What you need

- One or more torches with working batteries and globes.
- Some insulated wire (with plastic sleeve) from a hardware shop.
- Sticky tape may be handy but not essential.

What to do

- Undo the torch and take out a battery and the globe
- Use the wire and a battery to light the globe. Put them together so they look like the pictures below.
- Put a tick in the box if the globe lights up.



Note

The globe should light up three times - and only when the electricity from the battery can move from one end of the battery to the bulb and from the bulb to the other end of the battery. This circular movement of electricity is called a closed or complete circuit.

Follow on

- Loose connections (check out Tinkering unit)
- Safety with electricity - First Aid manual
- Fuses - why do you think we have them?
- List the appliances in your own home
- Write down any new words and a sentence using each one
- **circuit, circle, circus**
  Can you think of any other words starting with 'circ'?
  Have a look at a dictionary too.

Adapted from: ***Matter and Energy*** *by M. Mathias and R. Johnson, New Readers Press.*

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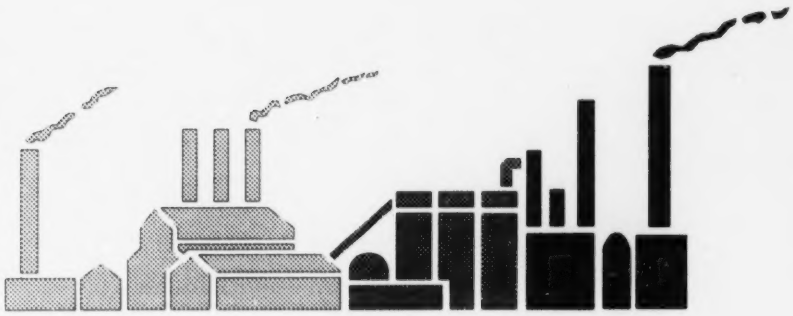
4. Green issues



These two units concerned with environmental issues are based on the work of two different groups in Melbourne.

Local action on chemical hazards

This unit is based on work by a Melbourne group after they had seen the play ***Chemical Reactions*** by the West Theatre Company. The play dramatised concerns about chemical pollution and industrial accidents in the western suburbs of Melbourne.

It is offered here to give ideas for how to approach this or other local issues. By investigating an issue important to them, this group developed research and writing skills, learnt to interpret information in different forms, learnt some scientific words and came to understand science as a human activity which affects everyone's life.

What you need

- Information from this unit!
- Articles in local papers.
- Information from local environment groups.
- A good dictionary.
- Local maps.

What to do

- Discuss what industry there is in your local area.
- Have you heard of any worries, dangers or accidents connected with it?
- Read and discuss **Recent accidents in Melbourne's West** sheet or a local article or information, if available.
- Write down all the words that are new to you. Use the dictionary to find out what they mean.
- Read and discuss **Health Effects** sheets.

- List/chart ideas and arguments from discussion, e.g.

1. **List in order of importance to you** (in pairs or small groups):

Job	Health
Environment	Economy
Profit	Future

2.

FOR	AGAINST
Companies do take precautions	Number of accidents too large
The dangers are very small	No independent proof
We need jobs, progress and development	Cost to health is too high
People want the products	Don't need the products - should find alternatives

- Study, discuss and interpret the chart **Early Adult Death**
- Read list of prosecutions by the Environment Protection Authority.
- ACTION – What can be done?
  - Brainstorm your ideas.
  - Read letters by the Melbourne group.
  - Read local newspaper articles.
  - Have your own letter writing campaign.
  - Invite speakers from industry and environmental organisations to talk to your group. What questions do you want to ask them?
  - Find articles in newspapers and magazines that relate to the issue. Read, discuss and display them.

Recent accidents in Melbourne's West

March 1st 1989	B.F. Goodrich, Altona	Vinyl chloride gas
April 24th 1989	Wallbridge Transport Moreland Street, Footscray	A 200 litre drum of caustic solution broke. Fork-lift driver injured.
April 25th 1989	B.P. Australia pipeline Altona	Leak of 10,000 litres of petroleum, near a residential area. Fire Brigade declared the area a high-risk zone because of the possibility of explosion.
May 15th 1989	F.B.T. Transport Amanda Road, Brooklyn	Chemical leak at transport depot. Surrounding area was evacuated.
June 5th 1989	Francis Street, Yarraville	Tanker spilt petrol outside Mobil terminal after collision with a truck. About 5000 litres of petrol went into nearby drains and flowed into the Yarra River.
August 1st 1989	Chemplex Australia Somerville Road, West Footscray	A valve leak created a mix of chemicals that formed a cloud of hydrochloride acid vapour. Workers at the factory were evacuated.
August 5th 1989	Petroleum Refineries Aust. Champion Road, North Williamstown	A 6000 litre distillate leak from pipeline. Extensive pollution of Kororoit Crk and the Bay with major effects on marine life.
August 14th 1989	Pipeline Western Highway, Deer Park	Broken pipe in a paddock. Traffic was diverted for two hours.
August 14th 1989	Safcol Holdings Whitehall Street, Footscray	Ammonia leak after pipe broke.

Health effects

In the western suburbs of Melbourne there are:

- Petrochemical companies (making resins, paints, rubber, solvents, fertilisers).
- Plastic manufacturers.
- Metal smelters.

Some of the chemical compounds they use are listed below. The health effects from contact with these chemicals will vary according to how strong they are and the length of time of exposure to them.

Styrene

Used in the manufacture of plastics, particularly polystyrene.

Health effects:
Eye and breathing irritations, weakness, tiredness, tension, nausea, loss of balance.

Vinyl Chloride

Used in the manufacture of plastic P.V.C. products.

Health effects:
Dizziness, drowsiness, unconsciousness. Several studies suggest an increased rate of miscarriages and decreased male fertility.

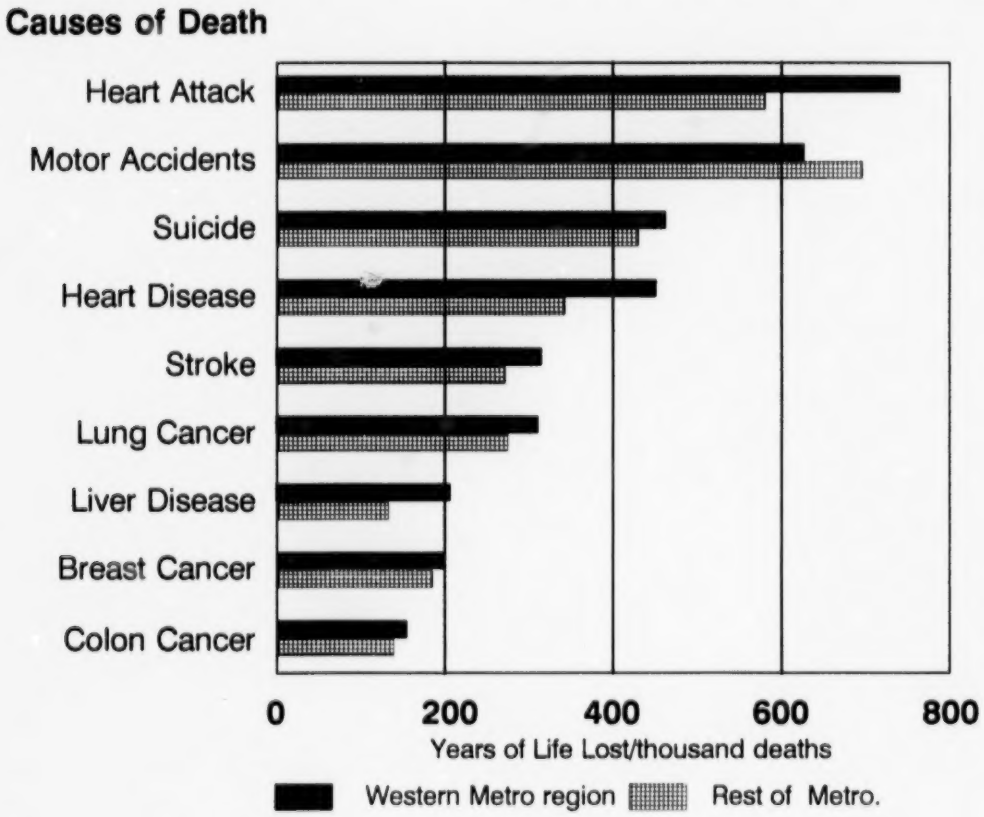
Arsenic

Used in the smelting of metals.

Health effects:
Cramps, weight loss, heart disease, eyesight problems, lower sexual activity.

Chemical Reactions

Early Adult Deaths from Specific Causes



Source: "A Picture of Health?", Western Region Division, Health Department of Victoria.

worksheet

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Bladder cancer

Bladder cancer issue erupts with sacking

By Tony Wells

THE bladder-cancer issue at Hoechst's Altona plant has blown up with the sacking of a union shop steward.

Members of the Amalgamated Metal Workers' Union have been on strike for a week in support of union rep Helmut Gries.

Mr Gries was dismissed by the company for what is said was a breach of contract in bringing an interview to television program "60 Minutes" over concerns about cases of possible bladder cancer among workers in the company's pigment section.

The Western Times reported last week that three pigment workers had returned abnormal findings during routine urine tests.

Each had been exposed to the chemical dichlorobenzidine (DCB), a known cancer-causing agent in animals.

One man was found to have traces of cancer in the bladder, another had a benign papilloma tumor in the bladder and the third is still undergoing tests at Melbourne's Peter MacCallum cancer clininc.

The "60 Minutes" program has not yet been screened. But, the current affairs team is understood to have set up its own van recently outside the Hoechst factory and tested Hoechst workers for bladder tumors.

Hoechst company secretary Michael Pont yesterday (Tuesday) denied that Mr Gries had been sacked because of any interview he may have done with "60 Minutes".

Mr Pont also stuck to the the company's line, as reported in last week's Western Times, that the abnormal findings in the three workers could in no way be proven to have a link to exposure to DCB's.

"It's getting a little bit out of hand," Mr Pont said.

AMWU organiser, Don Calderwood, said Mr Gries was a conscientious shop steward who had been "gravely concerned" about the health of fellow workers invoolved with DCBs.

Mr Calderwood appealed to any contractors or workers who had been employed in the pigment section at Hoechst over the past 12 years to come forward for testing.

He said these people should first approach the company and if they did not get any satistfaction, they should then approach the AMWU.

"If something does develop I understand you can be cured," Mr Calderwood said.

Mr Calderwood said AMWU members were on strike in support of Mr Gries' reinstatement.

The three pigment workers who returned abnormal findings in urine testing are members of the Australian Workers Union.

The AWU's health and safety officer Dr Yossi Berger has prepared a comprehensive report on the situation at Hoechst. It is due for release next week.

The metal workers' union covers maintenance staff in the pigment section.

Green issues letters

Dear Sir/Madam

I am concerned about our environment and the use of chemicals.

How big a area does B.P cover?

Are the Empoylees put throug a course on Health and Safety and Dangers involved with their work?

Does the Fire Brigade run a check on Extinuishers and Safety Equipment on the Complex?

In April 1989 B.P had a leak of Petroleum 10,000 H what has been done to prevent this from happening again?

Are the Residents aware of the Dangers and Hazard around them?

Do you think it is Safe to bring up a family in the area?

I look forward to a reply from you!

Green issues letters

Environment Officer
Petroleum Refineries Aust
Kororiot Creek Rd Altona

Dear Sir/Madam

I am seeking more information on the proposal of the future expansion of your refinery.

I don't live in Altona, but I have a few friends that do, and they are definitly moving out of the area. They feel that the already large refinery is becoming too much of a threat, and a health risk.

I have a few points that concern me:

Could you be more specific about the size of the proposed expansion of the refinery?

How will your safety standards develop in line with our proposed expansion?

What methods are you currently using the dispose of your toxic waste?

I look forward to receiving your reply

Yours sincerely

Prosecutions

Prosecutions by the Environment Protection Authority

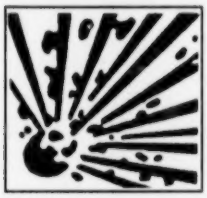
Defendant	Charge	Court	Date	Result
Pamane P/L	Breach of PAN: water pollution; unlicensed discharge	Preston	22/2/90	Fine: $14000 Costs: $600
Waste Mobile P/L	Permitting transport of wastes without a certificate; transporting waste in non - permitted vehicle	Melbourne	20/3/90	Fine: $2200 (11 Counts) Costs: $885
Altona Petro - chemical C/L	Air pollution	Williamstown	2/4/90	Bond: $2000 Court fund: $1750 Costs: $600
Browning - Ferris Industries (Aust) P/L	Water pollution	Heidelberg	4/4/90 Adjourned 4/4/91	Bond: $1000 Court fund: $1000 Costs: $1000
Ian Alexander Robson	Causing an environmental hazard	Heidelberg	4/4/90 Adjourned 4/4/91	Bond: $1000 Court fund: $1000 Costs: $1000
ICI Australia Operations P/L	Air pollution	Williamstown	6/4/90	Fine: $7500 Costs $625
Shire of Flinders	Breach of licence: contravention of transport regulations	Dromana	9/4/90	Bond: $2000 Court fund: $1000 Costs: $820
Shire of Kilmore	Contravention of transport regulations	Seymour	11/4/90	Bond: $1000 Court fund: $1000 Costs: $820
City of Warnambool	Breach of licence: contraventionn of transport regulations	Warnambool	12/4/90	Bond: $500 Court fund: $1000 Costs: $820
Alfred Thomas Milne	Water pollution	St Arnaud	24/4/90	Fine: $1500 Costs: $1100
Hazeldene's Chicken Farm P/L	Breach of licence: water pollution	Bendigo	27/4/90	Fine: $5000 Costs: $1663
Pacific Waste Management P/L	Permitting transport of waste without a certificate	Melbourne	1/5/90 Adjourned 1/4/91	Bond: $500 Costs: $1490
Sandhurst Dairies Ltd.	Breaches of licence & PAN; water pollution	Bendigo	7/5/90	Fine: $2750 Costs: $1445
Bonlac Foods Ltd	Water Pollution	Colac	8/5/90	Fine: $2500 Costs: $1546
Margaret Zachwieja	Littering	Broadmeadows		Fine: $2500 Costs: $1546
Petroleum Refineries (Australia) P/L	Air pollution	Broadmeadows	25/5/90	Fine: $7500 Costs: $1072
Amalgamated Food and Poultry P/L	Permitting transport of waste without a certificate	Melbourne	7/6/90	Fine: $12,600 (42 counts) Costs: $6401

Source: *EPA Review Spring 1990, Environment Protection Authority, Victoria.*

Hazard warnings

- Copy, cut them out and match symbol to meaning
- Use a dictionary to check any new words

This contains dangerous germs and bacteria.



This may explode.

This may catch fire suddenly.

This is a poison.

This can dissolve and burn many things – metals, skin, bones, plastic, paper and many more things.

This is radioactive.

Partly based on adapted material by the West Theatre Company for "Chemical Reactions."

worksheet

Rivers, pollution and salinity

This is based partly on a project run by a Melbourne group whose original idea was to learn something about their local environment by studying pollution in the Yarra River. It could be used to give ideas for work in your local area.

What they did

During discussion of plans for the project it became clear that some work was needed on the concept of a river. This involved the group in:

- discussing what a river is
- discussing where this river ran
- researching photos and maps
- driving/walking along the river
- marking the course of the river on maps
- noting the places the river ran through to get an idea of the distances involved
- describing the water in the river
- guessing what the river would look like at its source
- visiting the MMBW offices for information (this involved public transport, finding the office, approaching the counters, getting the right information).

The tutor wanted the group to generate their own ideas for finding out more about the river. They came up with the following:

- go for a boat ride on the river
- drive to see the start of it
- test the water at both ends of the river
- take some photographs
- find out how long it is and how deep
- go fishing

Other activities

Testing the water

- Collect samples from places (head waters and lower levels if possible).

- Look carefully at them to compare clarity, a magnifying glass may reveal different freshwater life.
- Hand netting may produce different samples of animals.
- pH meters could test waters' acid/base level (see **Of Cabbages and Chemistry**).
- Use a coffee filter paper to filter the water. Look closely at any residue.

Pollution

- Look at a map of the river and try to guess what sort of pollution might be in it and where it comes from.

Sources may be:

Household waste - sewerage
- detergents

Farm, industrial and mining waste - chemicals

Petrol and oil pollution - from ships and boats

Soil erosion - from farms, road and bridge building

Fresh water and pollution

- Without fresh water there can be no life on earth.
- We use water to drink, cook, clean and grow food. We swim in it, fish in it and boat on it. We also pollute it.
- Pollution happens when harmful things are added to water and change it.
- Oxygen is needed for plants and animals in water as well as on land. When natural wastes enter a river they are broken down by millions of bacteria. Bacteria cannot live without oxygen.
- If too much waste is put in a river, it cannot clean itself because there is not enough oxygen in the water.

Salinity

- If salinity is a possible problem, meters may be borrowed from Department of Conservation and Environment through the Saltwatch program.

Salinity and saltwatch

Salinity is caused by salts in soil or water. Too much can harm plants and animals. In Victoria, salininty is seen as the greatest single danger to the environment. Part of the Government strategy is Saltwatch which involves schools and community groups in monitoring salt levels in their localities. Adult education groups would be welcome to join in.

Contact: Saltwatch
Department of Conservation and Environment
PO Box 41
East Melbourne
Vic 3002
Tel (03) 412 4369

Further information from:

Salinity Bureau
2nd Floor
1 Treasury Place
Melbourne 3002
Tel (03) 651 6400

Rural Water Commission
590 Orrong Road
Armadale
Vic 3143
Tel (03) 508 2222

The Rural Water Commission also has videos for loan, eg

Assault on the Land - Rob Gel's Environment

1989: Box Hill College of TAFE; 30 minutes.
Causes of salinity are explained. Dryland salting, the relationship between irrigation decentralisation and salinity. Improved irrigation practices to arrest the problem. Community working groups efforts in salt mitigation.

Heartlands

1983: ABC Australia; 28 minutes
Causes of salinity in Australia. Composition of soil and sub-surface soil in affected areas. History of the problem. Early pioneers, treefelling; salinity and its relationship to irrigation farming. Rising water tables and tree planting programs.

Videos can be borrowed for two weeks. Tapes can be mailed to you or collected from:
Rural Water Commission
Marketing Branch
590 Orrong Road
Armadale Vic 3143
Tel (03) 508 2700

5. Memory and Learning

An important issue for many adult learners.

Memories are made of this

Here are a number of activities that introduce how memory works and some ideas for improving it.

What you need

- People
- This unit
- A picture
- Tray of objects (or drawing of tray of objects in this unit)
- Large cloth to cover the tray and objects

What to do

- **Picture**
  Ask students to look at the picture, then close their eyes. For a few seconds they will probably be able to 'see' the picture. This first stage of memory stores an exact copy of what is seen, felt, heard, smelt or tasted for a few seconds. Sometimes these memories are stored for longer in the brain. Personal memories are sometimes triggered by smell, sound, photos.

- **Numbers**
  Read aloud a series of random digits from those below. Start with 3 or 4 and ask group to recall them. Try 5,6,7 digits. By the time you reach 8 or 9 it should be clear that most people's limit is 7 plus or minus 2.

9 8 2 3 9 6 1 0 4 2
8 6 9 5 1 9 2 6 6 4
9 3 9 7 2 5 1 0 4 0
6 0 8 1 6 0 4 1 8 8
4 0 5 3 2 1 9 6 1 2

This shows the limits of the short term memory. Ask the group if they have their own ways of remembering important information such as phone numbers.

Perhaps list them eg

diary
calendar
pieces of string
writing notes
linking to other information

◆ **Chunking**

One method of helping your memory is called chunking. For example: 2773791 is more easily remembered as 277 3791.

- VFLBMUSNSWMCG is better remembered as
  VFL BMUS NSW MCG

The memory is also helped by linking to meaning (VFL - Victorian Football League etc).

Chunking can greatly extend the apparent capacity of the short term memory. This can be shown by teaching half the group a chunking strategy while the other half memorizes more haphazardly.

Divide the group in two so that each half cannot hear what is said to the other half.

To the first half say, "In a moment I am going to read a long list of words to you. I want you to try to memorize the entire list. Listen to the list and try to remember as much as you can."
Tell the second half of the group, "In a moment I am going to read a long list of words to you. I want you to try to memorize the entire list. Your task will be easier if you memorize the words in groups of three. Try to read them and then try to form a new image for each following set of three as I read it. For example, if the first three words were, "skate, bone, piano" you might picture a rollerskate with a bone in it on top of a piano. Give a few more examples so people are clear about this idea.

When ready, read the list below. Read loudly and clearly, allowing a relatively long pause between words.

CAR	**TREE**	**TOOTH**	**PENCIL**
WATCH	**CHAIR**	**VIOLIN**	**FLOWER HOUSE**
BICYCLE	**RECORD**	**PIZZA**	**BOOK**
DISH	**NAIL**	**TOWEL**	**APPLE**
MATCH	**FISH**	**SKY**	**SHOE**

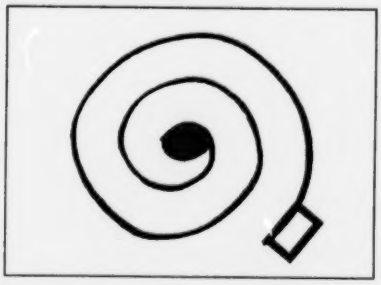
Wait a moment after completing the list, and ask each half group to say or write as many items as they can remember. Do this in two separate groups so they cannot hear each other. Notice that there are twenty-one items on the list. Students who use the chunking strategy will have only seven chunks to contend with, which should be a manageable number for most.

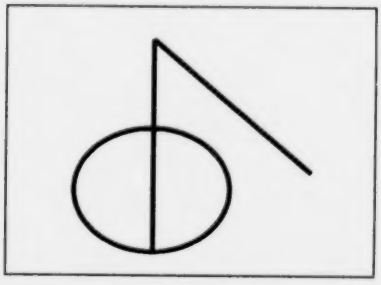
Did chunking help?

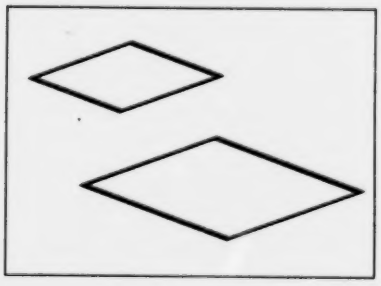
- **Shapes**

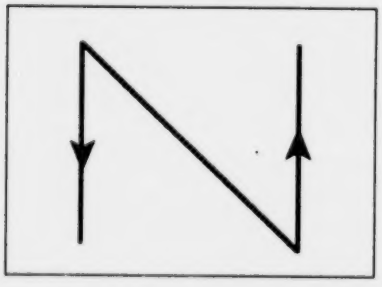
  Copy and cut up the shapes on the Shapes page that follows. Working in pairs, one person shows a card for 5 seconds then covers it. The other person then tries to draw what she remembers. Work through a few and then discuss which were easier to remember. Usually it will be the ones that linked with a shape already known. Information is easier to remember if you can link it to something you already know.

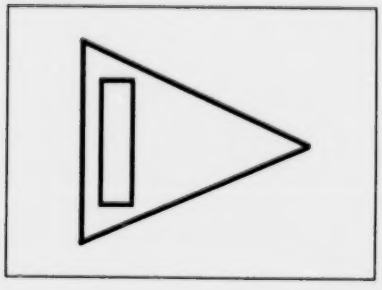
Shapes











- **Kim's Game**
  Look at the tray of objects for a minute or so. Cover, then try to remember what was there. Discuss different strategies people had for remembering.

- **Meaning**
  A crucial factor in deciding if something will be learnt and remembered is if it is meaningful to the learner. Read out or look at a list of words **(a)** for 15 seconds, then cover and try to recall them. Then do the same for list **(b)**.

(a)	**(b)**
history	**dragon**
silence	**carpet**
life	**arm**
hope	**hat**
idea	**teapot**
value	**apple**
mathematics	**pen**

Which list was easier to remember? Why?
Now try list **(c)**

(c)

Collingwood
won
the
Grand
Final
last
year

The group could also try making up its own list of words. Is it more easily remembered than a list given by someone else?

Rumours

What you need

A written message of no more than 75 words. It should be relevant and of interest to the group.

What to do

- Ask for 5 volunteers to leave the room. The rest are observers.
- Explain to the 5 volunteers that they will be brought back one at a time and told a message: The message will be given only once to each person.
- Call the first person back and read the message aloud. It is then passed on from memory. The second person is called in and hears the message from the first person. Continue until the fifth person who repeats the message to the whole group.
- Re read the original message and note distortions, deletions and mistakes.
- The five volunteers should have time to discuss how they felt and what happened to them during the process.

Whole group discussion can focus on how and why the message changed. Some implications for memory and learning might be

- importance of listening skills
- problems of one-way communication (learners need to be able to ask questions, ask for repetition)
- how facts can get distorted in the telling, people may remember only bits important to ***them.***

An example:

I've been trying to reach you. Nancy has just told me that the department's money has been doubled. There will be lots more classes, outings and writing weekends. The student group has to organise a meeting to give ideas for how to spend the money. We're meeting in Room 504 at 7.30 on Wednesday. Can you think of some ideas and also bring some biscuits? Thanks.

What does all this mean for learning?

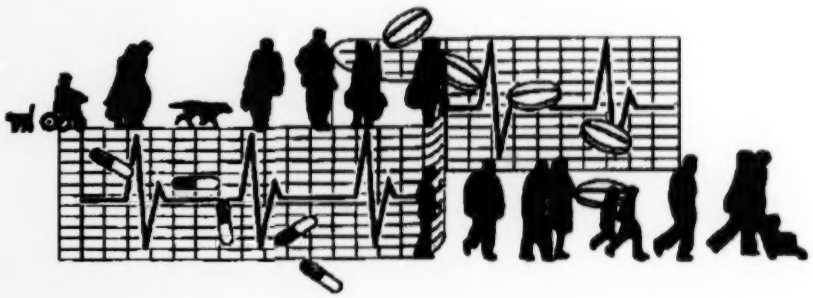
Many adults coming back to education and learning say things like "Of course I can't remember things as well as I used to." Our memories, like our bodies, do change as we get older, but this does not mean that we are not able to learn. Learning may take a little longer but adults have the advantage of experience which helps link new ideas to what is already in the memory. Our memories also get more choosy - picking up the information which is really important to us and ignoring other details.

Some strategies that can help

- Deliberately linking new information to what you already know.
- Repeating aloud or silently what you want to remember.
- Practising and reviewing frequently and at regular intervals.
- Doing something makes it more likely that you will remember it.
- You will remember better if the information means something to you, if you are interested in it and understand it and it is relevant to you and your life.
- You learn best when you are enjoying yourself.
- Distractions can really get in the way of your memory. Try to study in a warm, well lit, quiet place.
- Organise your notes and paper so you can find things easily and revise and practice. Have a ring binder or folder.
- Write down things as clearly as you can. Try out different pens to get different effects. Underline, or highlight important facts.

Adapted from: 'Taught not caught' by the Carity Collective. Published by Spiral.

6. Science in society



An assortment of activities and information to put science firmly in its place - as a human activity with relevance to people's lives.

From durians to dialect

This is a game which introduces people to the scope of science by reading and grouping some interesting information.

What you need

- Copies of the pages in this unit ideally stuck or copied onto thin card.
- Scissors.

What to do

- Cut up the fact cards.
- Shuffle and deal out as many as you want to the group.
- Take turns to read out your cards — discuss them as you go along.
- Place each one next to the topic name you think it best fits. (You may want to use just 3 or 4 topics as some are easier to read then others). This can be done individually or as a group.
- Give reasons for your decision.

Follow on

- Add to the list of possible science topics.
- Brainstorm facts and questions that you have always wondered about.
- Research the information.
- Design a poster or calendar to display the information.
- Design a card or board game using the information.
- Find out about different sorts of classification used in science.

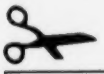
From durians to dialect

Topics

SOUND	FRUIT
HEALTH	INVENTIONS
ENVIRONMENT	LANGUAGE
ARCHITECTURE	OCEAN LIFE

From durians to dialect

Language



Noah Webster wanted words to be spelled as they sounded "Hed," "masheen," and "thum" appeared in his 1806 dictionary, but never came into use.	In English there are 8 different ways of pronouncing "ough".
The most common surname in the world is Chang. The most common English surname is Smith.	India has 845 languages.
The oldest writing system still in use today is Chinese.	In an industrial society, the everyday vocabulary has some 6,000 words.
In some Eskimo dialects, there are more than 50 terms referring to ice and snow.	There are currently 5,445 languages spoken in the world.

From durians to dialect

Environment

The **Rain Forests** act as the "green lungs" for our planet by taking in carbon dioxide and giving out oxygen. They are a home to animals and plants not found anywhere else.	The **Greenhouse Effect** is produced by a layer of carbon dioxide and other gases in the upper atmosphere that trap the sun's energy, thus warming up the atmosphere and the earth.
Tropical rain forests contain half the world's species of which one a day are now becoming extinct.	In December 1987 it was discovered that the large hole in the ozone layer which is found over the South Pole each year had drifted over Australia, possibly putting its people at risk.
Acid Rain is made of chemicals that fall to the ground as acids in rain, snow, hail or fog. Acid rain damages buildings, acidifies lakes, kills fish and destroys forests.	As North American cities are running out of dumping space for garbage, people are made to recycle by law.
Nearly two billion people in the developing world do not have safe drinking water.	**A Layer of Ozone** in the upper atmosphere protects the earth from the sun's ultraviolet rays. Chloroflourocarbons, used in aerosol spray cans, refrigerators and air conditioners are breaking down the ozone layer.

From durians to dialect

Health

Pain falls into three categories; pricking, burning or aching.	Oils in garlic and onions have been shown to reduce the cholesterol level in the blood.
Eating four or five small meals a day is healthier than eating three big ones.	Your brain ignores more than 99% of the messages it receives, allowing you to concentrate on what interests you at the moment.
About 60% of people need eight hours of sleep each night. The rest can get along with anywhere from two to twelve hours.	An average pregnant woman's weight gain breaks down as follows: 3.5 kg for the baby, 3 kg for the amniotic fluid, and 3 to 5 kg in extra fat and water throughout her body.
Walking three or four kilometres every day will exercise virtually every muscle in your body	People who live together for a long time begin to resemble each other internally (blood chemistry, cholesterol levels, etc.) as well as externally.

From durians to dialect

Sound

Sound is caused when an object vibrates, creating movement in air, water or solids.	Sound travels faster through solids and liquids than through air.
The noise problem caused by landing aircraft is usually greater than for a plane taking off because it is closer to the ground longer, and its noise is a high-pitched whine versus a rumble.	Low-intensity continuous noise can cause permanent hearing loss if a person is exposed to it daily for several years.
The brain begins collecting sound memories at birth. By adulthood we know half a million different sounds.	You hear sound when the sound wave moving through air reaches your eardrum causing it to vibrate.
Extremely high-intensity ultrasound can be used to kill insects, pasteurize milk and drill teeth.	Lightning and thunder reach us separately in a storm because light travels faster than sound.

From durians to dialect

Fruit

The seeds, rind and juice of citrus fruits act as a natural pesticide.	Raisins were first developed in Asia Minor, when people buried fresh grapes in hot desert sand.
A kilogram of lemons contains more sugar than a kilogram of strawberries	Blueberries are just about the only blue food.
Tomatoes, actually a fruit, not a vegetable, were once called love apples, because they were thought to be an aphrodisiac.	Called "King of the Fruits", the durian, a large, spiky-skinned fruit from Malaysia, is delicious, but its smell is so bad it is banned from hotels, hospitals and commercial airlines in South East Asia.
New Zealanders changed the name of the Chinese gooseberry to kiwi fruit so that Americans would be more likely to buy them. (It worked).	In ancient Greece, tossing an apple to a girl was a proposal of marriage, and catching it an acceptance.

From durians to dialect

Inventions

Around 3000 BC, See-Ling-she, the wife of a Chinese emperor, discovered how to make silk.	In 1869, margarine was invented as a cheap substitute for butter in a contest sponsored by French Emperor Napoleon III.
The atomic bomb (1945) was invented in the United States by a group of scientists including Enrico Fermi, Albert Einstein and J.R. Oppenheimer.	The portable electronic calculator was introduced by the Japanese in 1970, twenty years after the first commercial computer was produced in the U.S.
The birth control pill was first marketed in 1960, as a result of Mexican and U.S. research.	In 1868 Matilda Webb in Melbourne patented an invention to stop meat going off.
When she was 17 Mary Potts designed an iron with a removable wooden handle. It was patented in 1880.	Even though she had discovered radium, Marie Curie was refused admission to the French Academy of Sciences.

From durians to dialect

Ocean Life

Ultrasonic beepers placed on fishing nets produce high frequency sounds that whales don't like, protecting the whales from the nets, and the nets from the whales.	Some female fish found along the Great Barrier Reef change from female to male if there are not enough males around.
In 1891 James Bartley was swallowed by an enormous sperm whale. 18 hrs later, when the blubber was being removed from the dead whale, Bartley was found unconscious but still alive.	The most feared shark is the Great White Shark of JAWS fame which can grow up to 7 metres in length.
A starfish that is torn apart can re-grow its missing parts and become two new starfish.	While most fish sleep part of each day, they can't close their eyes because they don't have eyelids.
The male seahorse looks after its young in a special pouch from which they hatch.	Many saltwater crocodiles live for over 70 years.

From durians to dialect

Architecture

In the last 30 years, more buildings have been constructed than in the past 300 years.	The leaning tower of Pisa, Italy, leans because the ground under the foundations has been subsiding and is now about 4 metres out of line.
In 1646 AD the Taj Mahal in India was built by Emperor Shah Jahan in memory of his dead wife. It is thought to be one of the most beautiful buildings in the world.	Between 2,700 and 2,200 BC some seventy pyramids were built in Egypt.
In 1,000 AD the city of Angkor in Cambodia was the world's largest city covering 70 sq. km, designed for over 1 million people.	Today buildings are using 50% of all our energy for their lighting, heating, air conditioning, computers etc..
Some techniques of modern architecture have proved unhealthy including asbestos insulation, high alumina cement and air conditioning.	The house of the future may use solar or wind power and its own recycled waste as fertilizer for its food garden.

Adapted from information on the science Calendar 1990 by Pomegranate Calendars and Books, Science Trivia Unlimited.

worksheet

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Women in science

Some useful material on history, witches and Rosalind Franklin for reading, discussion and writing about.

Some history

"Science" originally meant "knowledge". Now "science" just means knowledge about the physical world, and scientists are the people who get that knowledge by observing, making guesses from their observations and experimenting.

We don't know the names of the first women scientists, because they lived in pre-historic times. We hear a lot about "man the hunter", but while men were hunting for food, women were gathering plants for food. So women first learned which plants could be eaten and which plants were good for illnesses and how to grow crops. The sciences of botany, medicine and agriculture were begun by women.

Many writers believe that women also worked out how to make fire. Women certainly learned how to use fire to cook food and to harden clay pots. Women also made the first houses, the first chimneys and ovens, the first woven clothes and the first knives. They tamed animals, made salt and invented the mortar and pestle.

In some societies women still do all these things. A Kurnai aborigine said that man's work was to hunt, spear fish, fight and then "sit down" - women's work was to do "all else". In Western societies some people feel that women's work is looking after the home, while men's work is "all else". But women began the work of learning about the physical world.

Ancient Greece

The ancient Greeks kept women out of education and public life, but some of the Greek teachers believed that women should be allowed to learn the new ideas. The school of Pythagoras, which first said that the earth was round, had 28 women students and teachers. Plato, who worked out the first theories of scientific study, let women into his academy, even though there was a law against women going to public meetings at the time.

Women had the chance to learn, and as a result there were important women scientists. Arete of Cyrene taught natural philosophy (the beginnings of modern physics) for thirty five years. During this time she wrote forty books and taught one hundred and ten philosophers. The people of Thessaly however, called her a witch, because she had worked out how to predict eclipses of the sun and moon - and she encouraged them by saying that she would make the sun and moon disappear.

Other women of ancient Greece had to fight for their learning. Agnodice, who lived in Athens around 300B.C., wanted to become a doctor. Because women were not allowed to be doctors, she dressed in men's clothes and went to study in Alexandria. When she came back to Athens and began to see women patients, other doctors were jealous and criticised the new "male" doctor. Agnodice told them she was a woman and was put on trial for breaking the law. All her women patients went to the judges and said that Agnodice had saved their lives, so they would die with her if she was condemned. So the judges changed the law. After that Greek women could study and write about medicine, though they could only treat other women.

Witches

Scientists asked questions to find out more about the world, but the Christian Church in the Middle Ages had clear ideas about the world already. People who went on asking questions, like the scientist Galileo, were punished by the Church, often with death. Many people who were punished in this way were called witches.

The witch-hunts lasted from the fourteenth to the seventeenth century. Millions of people were killed. Witch-hunts were organised and paid for by the Church. The handbook, the *Hammer of Witches*, written in 1484, tells priests and judges how to start a witch-hunt, how to get people to accuse each other, and how to make people confess by torture.

Many of the witches were healers and midwives. They used herbal remedies, tested by years of use. Many of the remedies - ergot, belladonna and digitalis, for example - are still used by doctors today.

The witches worked by trial and error and observation, to find ways to deal with disease, pregnancy and childbirth. In short, their "magic" was the science of the times. In contrast, the university-trained doctors used astrology and charms to treat their patients. For example, Edward II's doctor treated toothache by writing "In the name of the Father, the Son and the Holy Ghost, Amen" on the jaws of the patient. So the doctors fitted in with the Church, but the witches did not. As a result, the witches were killed in great numbers, and their knowledge came to be seen as "old wives tales".

Rosalind Franklin 1920-1958

Rosalind Franklin was born in England. Her father had planned to study science until stopped by the First World War, but when Rosalind decided to become a scientist he suggested that she take up social work instead. Rosalind argued with him and won.

She studied science at Cambridge and from the start was a dedicated scientist. She decided at university that she would not marry, because it seemed to her that women had to choose between work and home life.

When the Second World War started, Rosalind applied for war work. She was given a job as an assistant research officer with British Coal. She enjoyed her job because she could work on her own. She wrote a number of articles and completed her doctorate in her four years there.

At the end of the war when Rosalind was twenty five, a French friend from Cambridge introduced her to a French scientist who encouraged her to take a job in France. Rosalind loved France, became more confident, and began to learn about x-ray crystallography.

In x-ray crystallography, x-rays are passed through a crystal of whatever the scientist wants to study. They make a pattern on film which can show things as small as the atoms of a molecule. Rosalind liked the idea of studying the atoms of living things. The most important project in this subject at the time was the study of DNA. Scientists were trying to work out how people inherit different characteristics. DNA is one of the acids in the chromosomes, which pass on genetic information. Rosalind decided to go to King's College in London to set up an x-ray crystallography unit there.

She had two pieces of bad luck in her new job. One of her fellow workers, Maurice Wilkins, thought he should do all the work on DNA and argued with everything Rosalind did. To make matters worse, women were not allowed in the staff dining room at King's College, so Rosalind was set apart from the men she worked with and became very isolated.

But she worked on, and in 1952 gave a talk on DNA which brought out a lot of new information. Wilkins showed Rosalind's photographs to a Cambridge scientist, James Watson, without her permission, and his partner, Crick, used the information to complete the study of the DNA molecule.

Rosalind moved to Birbeck College in London, where she did x-ray work on viruses. She liked her fellow workers there, and she liked her work. In five years she published seventeen articles and made many new discoveries. In 1958 she died of cancer at the age of thirty seven.

Rosalind had made important contributions in three areas of science. But she was almost forgotten. In 1962 Crick, Watson and Wilkins shared the Nobel Prize for their work on DNA. In the stories of the discovery of DNA, Wilkins took the credit for Rosalind's x-ray work. Worse still, in his best-selling story of the discovery of DNA, ***The Double Helix,*** Watson described Rosalind as Wilkins' assistant, an unattractive, glasses-wearing woman who held up DNA research by her rigid opinions, and who physically threatened her fellow workers. This is a typical comment by Watson: "Clearly Rosy had to be put in her place... if she could only keep her emotions under control, there would be a good chance that she could really help Wilkins."

Anne Sayre, an American writer who had known Rosalind Franklin, knew that she did not wear glasses and was never called Rosy. She wondered what else was wrong with Watson's story. In her book, ***Rosalind Franklin and DNA***, Sayre suggests that Watson turned Rosalind into an unattractive character because he took her photographs and gave her no credit - if she wasn't very nice, his behaviour wouldn't look so bad. Also, he could get away with it because Rosalind was dead.

Watson's picture of "Rosy" is a stereotype of a woman who becomes unfeminine by working in a man's world. Sayre actually heard a man asking his school board to drop science for girls because he didn't want his daughter growing up "like that Rosy what's her name in that book".

Rosalind Franklin was a good, productive and honest scientist and her work was vitally important in the discovery of DNA. Her story shows us how easily women scientists can disappear from history.

Science is . . . . .

Having a look at how science is seen by the media and society.

What you need

- Science wordwheel.
- Lots of different popular newspapers and magazines.
- Scissors.
- Poster/butchers' paper.
- Glue.

What to do

- Brainstorm all the words that come to mind when you think of science.
- List them.
- Choose eight to fill in wordwheel.
- Working in 2s or 3s people choose a newspaper or magazine.
- Try to find articles, pictures or cartoons related in some way to science.
- Tell the rest of the group about them.
- Can they be grouped at all?
- Cut them out and stick them up.
- Make a list of the topics.

Some questions

What sort of science is shown?
Is it related to our everyday lives?
Does it make you interested in science or not?
Why?

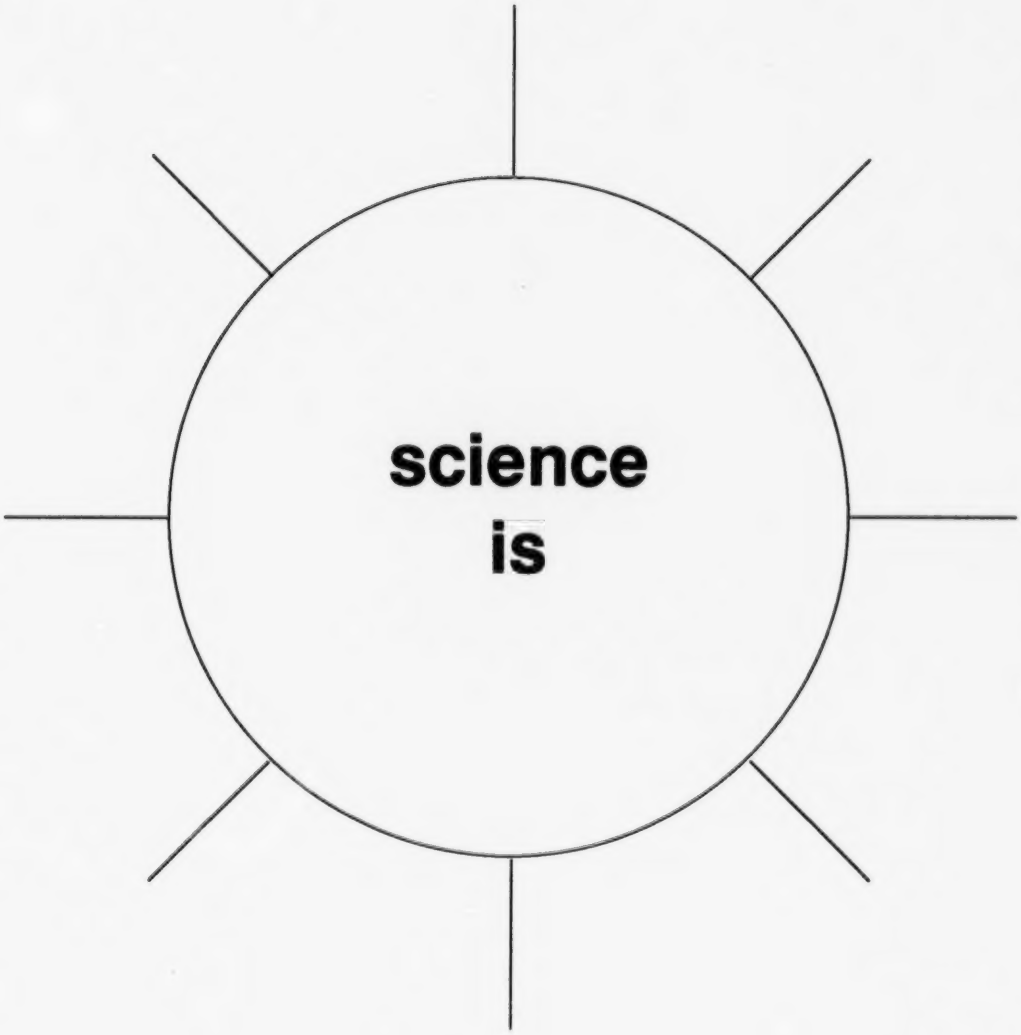
Follow on

- Write about how science is presented in the media.
- Watch some TV Science programs (or hire a video - see resources).
- List words from the articles that were new.
- Are there any particular issues from the articles that you want to follow up?
- Which articles are about topics that are important to society?
- Have a look at the unit called From Durians to Dialect.
- Collect some of the words from the articles that seem scientific. What do they mean? Why are they used? Maybe you have a hobby or work in a job that uses special words to describe things.
- List all the special words to do with a subject you know about. (Maybe fishing, sewing, Social Security)

An example: **Sewing**

seam	hem
pattern	overlocker
tack	selvedge

Adapted from 'Getting into Gear and Gender Equity in Mathematics and Science' by Sue Lewis. Published by Curriculum Development Centre.


science
is

7. References and resources

References and resources

Food for thought

Food Fun Book Rosemary Stanton, Ellsyd Press 1988.
Written for children but includes quizzes and interesting articles suitable for adults.

Nutrition for Life Catherine Saxelby, Reed Books 1986.
A mine of information for the tutor. Contains pictures to illustrate groups of food with such things as high salt, low salt.

Food What's In It A to Z of Food and Nutrition Catherine Saxelby, Reed Books 1989.
Each food is listed alphabetically with a short section about its nutritional value. More interesting than it sounds and many facts and figures.

Food and You A commonsense approach to nutrition Rosemary Stanton, Holt, Rinehart & Wilson 1984.
Not an exciting looking book but contains many ideas for activities and many facts from a reputable Australian dietician.

Eat for Health Margaret Palmer, Longman Paul 1982.
Well presented New Zealand book on nutrition with many activity ideas, awareness of world and social issues and even recipes!

Additive Code Breaker Maurice Hansen and Jill Marsden, Lothian Publishing.

Health Department Victoria
555 Collins Street
Melbourne (03 616 7777)

Victorian Food and Nutrition Program
P.O. Box 6
Flinders Lane
Melbourne 3000

Victorian Aboriginal Health Association
186 Nicolson St
Fitzroy 3065 (03 419 3000)

Cabbages, cleaning and chemistry

Colourful Chemistry J. Gipps and E. Friedman, STAV Publishing 1990.

Great Explorations in Math and Science (GEMS) series, Lawrence Hall of Science.

Chemists in the Classroom: Water Roxanne Rodgers, The Science Shop 1989.

Green Issues

Youth Power magazine South Australian Development Education Centre (SADEC) 1st floor 155 Pirie Street Adelaide 5000.

Aimed at schools but good resource information on development topics - quizzes, poems, plays.
Issue No.11 (Winter 1990) had good material on environment and consumerism.

Greenhouse Alert - a learners handbook Helen and David Duffy for the Social Education Association of Australia, Dellasta, Melbourne

Australian Conservation Foundation
340 Gore St
Fitzroy Victoria 3065 (03 416 1166)

Conservation Council of Victoria
247 Flinders Lane
Melbourne 3000 (03 654 4833)

Friends of the Earth
312 Smith St
Collingwood Victoria 3066 (03 419 8700)

Tree Victoria revegetation programs: Department of Conservation and Environment (Contact local office as listed in the telephone directory).

Rural Water Commission of Victoria
590 Orrong Road
Armadale 3143 (03 508 2222)
Series of project sheets on topics such as water pollution.

Greening Australia (008 014273)

'***It's not all Rubbish***' a video about a group of high school students starting a recycling campaign in their school - lots of information on recycling processes.
Produced by TV Education for the ACF (27 minutes). Available from:
The Education Shop
117 Bouverie St
Carlton 3053 (03 342 3939)

Greenhouse Activity Materials: Secondary from Greenhouse Action Australia
P.O.Box 575
Carlton South Victoria 3053

CSIRO Division of Atmospheric Research
Aspendale Victoria
Information leaflets, a bibliography and book lists on Greenhouse and ozone.

Environment Protection Authority
Olderfleet Buildings
477 Collins Street
Melbourne 3000 (03 628 5533)

24 hour complaints line on pollution location, time, nature of probable source if known.
(03 628 5777)

Seeing the light

Spaces: Solving Problems of Access to Careers in Science and Engineering, Sherry Fraser et al. Lawrence Hall of Science, Dale Seymour 1982.

Energy Information Centre
139 Flinders Street
Melbourne 3000 (03 650 1195)
(008 136 322)

Matter and Energy, Marilynne Mathias, New Readers Press

Physics Demonstrations, F.G.Armitage, E.J. de Jong, W.A.Rachinger, STAV
Clunies Ross House
191 Royal Parade
Parkville Victoria 3052

'Saving Your Energy Dollar' and many other publications available from
Public Relations Department
State Electricity Commission of Victoria
15 William Street
Melbourne 3000

Memory and learning

Your Memory: A User's Guide, A. Baddeley, Penguin 1982.

Remembering Made Easy, J. Dineen Coles, Canada 1979.

Introduction to Psychology, D. Coon 1986.

Science in society

Australia 2020 Handbook, Gould League.

Getting into Gear: Gender inclusive teaching strategies in science, McClintock Collective, Curriculum Development Centre, Canberra 1988.

Better Links: teaching strategies in the science classroom, Peter Grant, Louise Johnson, Yvonne Sanders - STAV publishing.

Here Come the Philistines, Robyn Williams, Penguin.

Women in Mathematics and Science, Jenny Pausacker, TEAC 1982.

Other sources of ideas and information

Science is . . ., Susan Bosak 1986.
- notion of Science Fairs
- Science Olympics
(Family Science type materials)
Youth Science Foundation
Suite 904, 151 Slater Street
Ottawa Canada

Science Problem Solving - A Learning Strategy, George Hook and Brent Ingram, Longman Cheshire N.Z 1989 Aust. 1990
User Friendly Resources 1989. (i.e. copywrite free for classrooms)

Activity Kit, Family Science Project, Australia
Swinburne Institute of Technology
P.O.Box 218
Hawthorn 3122 (03 819 8735)

Cracking Up, Cheryl Jakab, Thomas Nelson
For primary students, but an amazing range of activities and experiments with eggs.

Entertaining Science Experiments with Everyday Objects, Martin Gardner.

A History for the Future: Australian Women in Science and Technology (22 mins.)
Equality Videos
P.O.Box 357
Prahran Victoria 3181 (03 826 2739)

The Young Scientist Investigates - Teachers' book of practical work, Terry Jennings O.U.P.
150 'simple' experiments

Frameworks: Science and Technology P-10, Ministry of Education, Victoria.

Women and Work, Barbara Bee, N.S.W. Dept of TAFE 1989
Section on women, work and technology.

Women in Science Education Report, Leonie Gianello and Colin Hocking, Holmesglen College of TAFE 1986.

Springboards: Ideas for Science, Nelson

How to make square eggs, Paul Temple and Ralph Levinson, Hamlyn 1982.

TV and Radio programs:

- **Towards 2000**
- **Quantum**
- **Science Show**
- **Earthworm etc.**

Other useful addresses

Australian Science Teachers Journal.
c/o University of South Australia
Smith Road
Salisbury East
South Australia 5109

Anti Cancer Council of Victoria
1 Rathdowne Street
Carlton South 3053 (03 663 3412)

Science Shop
477 Burwood Road
Hawthorn 3122 (03 819 8705)

Equal Opportunity Resource Centre
19 Bell Street
Fitzroy 3065 (03 418 4560)

Science Teachers Association of Victoria (STAV)
Clunies Ross House
191 Royal Parade
Parkville 3052 (03 347 2211)

Gould League of Victoria
67 High Street
Prahran 3181 (03 51 1701)

John Gardiner Centre
Tooronga Road
Hawthorn East Victoria 3123
(for newsletters, workshops and information. School focus but many excellent ideas easily adaptable for adults).

Possible excursions

National Science and Technology Centre - Canberra

Victorian Technology Centre - Port Melbourne

Centre for Education and Research in Environmental Strategies - CERES
Greenhouse Trail
8 Lee Street
Brunswick Victoria (03 556 2396)

CSIRO also have a register of women scientists who are happy to talk about their work.

Energy Education Centre
off Yarra Boulevard
Burnley Victoria Book through the Energy Information Centre

(03 650 1195)
(008 136 322)

Scienceworks
2 Booker Street
Spotswood Victoria (03 392 4819)

Slices of Science:

a resource for Adult Basic Education

Project Officer: Avril Blay
Council of Adult Education, Melbourne

Published by the Adult, Community and Further Education Board, Victoria

The content of the Adult Basic Education curriculum has often been wide ranging but has rarely included much science. There are many reasons for this, an important one being the scarcity of activity-based science resources for adults developing their language and maths skills. ***Slices of Science*** suggests a few ways of filling this gap and also points to the possible role science might have in the Adult Basic Education curriculum.

Slices of Science is the result of ideas and work by practising teachers of Adult Basic Education. Most of the contributors have a background in science. The aim was to produce materials that are easy for people to use, that demystify science, relate it to everyday life, introduce topics through interesting and enjoyable activities and provide an extra stimulus through which to develop language and maths skills.

Adult Education in the Community

CAE